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Marine Flora and Fauna of the Northeastern United States. Crustacea : Decapoda

AUSTIN B. WILLIAMS

SEATTLE, WA
April 1974

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Marine Flora and Fauna of the Northeastern United States. Crustacea : Decapoda

AUSTIN B. WILLIAMS

Seattle, WA
April 1974

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FOREWORD

This issue of the "Circulars" is part of a subseries entitled "Marine Flora and Fauna of the Northeastern United States." This subseries will consist of original, illustrated, modern manuals on the identification, classification, and general biology of the estuarine and coastal marine plants and animals of the Northeastern United States. Manuals will be published at irregular intervals on as many taxa of the region as there are specialists willing to collaborate in their preparation.

The manuals are an outgrowth of the widely used "Keys to Marine Invertebrates of the Woods Hole Region," edited by R. I. Smith, published in 1964, and produced under the auspices of the Systematics-Ecology Program, Marine Biological Laboratory, Woods Hole, Mass. Instead of revising the "Woods Hole Keys," the staff of the Systematics-Ecology Program decided to expand the geographic coverage and bathymetric range and produce the keys in an entirely new set of expanded publications.

The "Marine Flora and Fauna of the Northeastern United States" is being prepared in collaboration with systematic specialists in the United States and abroad. Each manual will be based primarily on recent and ongoing revisionary systematic research and a fresh examination of the plants and animals. Each major taxon, treated in a separate manual, will include an introduction, illustrated glossary, uniform originally illustrated keys, annotated check list with information when available on distribution, habitat, life history, and related biology, references to the major literature of the group, and a systematic index.

These manuals are intended for use by biology students, biologists, biological oceanographers, informed laymen, and others wishing to identify coastal organisms for this region. In many instances the manuals will serve as a guide to additional information about the species or the group.

Geographic coverage of the "Marine Flora and Fauna of the Northeastern United States" is planned to include organisms from the headwaters of estuaries seaward to approximately the 200-m depth on the continental shelf from Maine to Virginia, but may vary somewhat with each major taxon and the interests of collaborators. Whenever possible representative specimens dealt with in the manuals will be deposited in reference collections of the Gray Museum, Marine Biological Laboratory, and other universities and research laboratories in the region.

After a sufficient number of manuals of related taxonomic groups have been published, the manuals will be revised, grouped, and issued as special volumes. These volumes will thus consist of compilations of individual manuals within phyla such as the Coelenterata, Arthropoda, and Mollusca, or of groups of phyla.

CONTENTS

	Page
Introduction	1
Glossary	2
Key to the marine decapod crustaceans of the Northeastern United States, inshore and shelf waters	4
Annotated systematic list	39
Selected bibliography	44
Index to scientific names	48
Acknowledgments	50
Coordinator's comments	50

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MARINE FLORA AND FAUNA OF THE NORTHEASTERN UNITED STATES. Crustacea: Decapoda

AUSTIN B. WILLIAMS[1]

ABSTRACT

The manual includes an introduction to general classification, an illustrated key, an annotated systematic list, a selected bibliography and a systematic index to the marine decapod crustaceans of the inshore and continental shelf waters of the northeastern United States.

INTRODUCTION

The Order Decapoda contains the largest and probably most familiar crustaceans occurring along seacoasts of the United States. Generally speaking there are two main body types exhibited by this group. The first group is long tailed with a conspicuously extended abdomen and the whole body usually compressed (narrow and deep). These are the shrimps (Suborder Natantia) with abdominal swimmerets (pleopods) well developed and adapted for swimming (Fig. 1). The second group (Suborder Reptantia) is diverse in shape, lobsterlike or crablike, with the body more or less depressed (dorsoventrally flattened). Three subsets within this assemblage are fairly distinct: 1) lobsters and mud shrimps (Section Macrura) with abdomen extended and always equipped with a tail fan, adapted for feeble swimming, crawling, or burrowing; 2) an anomalous group (Section Anomura) that either have the body asymmetrical and adapted for housing in hollow objects (hermit crabs), or symmetrical with the abdomen fairly well developed but more or less flexed under the thorax (porcellanid crabs and relatives); and 3) short tailed true crabs (Section Brachyura) with greatly reduced abdomen more or less permanently flexed beneath the thorax, adapted primarily for locomotion on a substrate (Fig. 2).

These body types have been variously treated in forming classifications of the higher categories of decapod crustaceans for nearly 200 yr and the one that is adopted here has become the conservative (and practical) arrangement used for the last few decades. It is a classification that considers the long tailed forms to be most primitive, the anomalous group to be composed of radiating side branches of the main stem, and the short tailed forms to be the most specialized in the order. Such a broad statement does not do justice to fine points of supposed relationships based on many lines of evidence but will serve as a working outline.

The decapod crustaceans treated here are restricted to species living within the 200-m limits of the neritic province, on beaches, or nearby marshes along the northeastern United States. Species living primarily outside these limits off the northeastern United States have distributions which extend far beyond the region, hence are seldom part of the local fauna. A few species bridge the neritic and oceanic provinces and these have been selectively included. Within the continental shelf area, only species with recorded occurrence between southern New Jersey and the northern border of Maine are considered.

The shrimps and crabs of this area belong essentially to two temperature regimes, a boreal component in the north which includes some arctic species and a temperate component in the south which embraces a few invaders from both the boreal as well as the warmer Carolinian Province south of Cape Hatteras. Cape Cod forms a landward boundary between these regimes of temperature, though offshore

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there is a good deal of latitudinal displacement and the whole seasonally oscillates to some degree in a north-south fashion.

The essential composition of this crustacean fauna has been well documented since the turn of the century, but there have been refinements in species definitions, limits of ranges, and some new discoveries. This key borrows heavily from the past, but a new set of illustrations and restructuring should make it more usable than the older keys or their abridgments.

The key is designed for biologists, biology students, and informed amateurs. The format consists of a series of contrasting statements almost always offering two clear alternatives, although sometimes supplementary information is added. The user selects that statement in a couplet that fits best. This will lead to a number which heads a new set of alternatives. Eventually the choices lead to a specific name. Names of higher categories are included. Numbers in parentheses allow a user to work the key in reverse, any parenthetic number being that of the preceding couplet in the sequence.

Labelled diagrams and a glossary of technical terms are provided. Almost all characters employed in the dichotomies are illustrated by line drawings, but these may not adequately differentiate the species outside the area of the northeastern United States. Wherever practicable, drawings were made of specimens from the northeastern United States. Scales on all figures are in millimeters.

An annotated list of 92 species is given separately. Among this number are exceedingly scarce species as well as abundant ones. Only 17 of the latter are large enough to be valuable in commerce, but these contribute to some of our richest fisheries. The shrimps, *Penaeus setiferus* and *P. aztecus aztecus,* whose centers of distribution are in the Carolinian Province, are commercially exploited by trawling only south of Cape Hatteras. Their northern counterparts, *Pandalus borealis* and to a lesser extent *P. propinquus* and *P. montagui,* occur in a smaller trawl fishery from Cape Cod Bay to the Maritime Provinces of Canada. The American lobster, *Homarus americanus,* long a favorite seafood, is caught mainly by trapping in cold temperate waters of the continental shelf northward from Cape Hatteras. The American blue crab, *Callinectes sapidus,* which thrives in estuaries, is caught by a variety of means from Long Island to Texas and marketed in both hard- and soft-shelled states.

The systematic and distributional section is followed by a selected bibliography of systematic and general biological works at the end.

GLOSSARY

abdomen jointed hind part of body; tail; consisting ideally of 6 segments; muscular, extended or bent in shrimps, lobsters, etc.; asymmetrical in hermit crabs; reduced and more or less permanently held beneath thorax in crabs.

adrostral groove groove beside base of rostrum extending posteriorly along dorsal side of carapace (on shrimps).

antenna one of second pair of appendages; movable segmented organ of sensation behind, below, or lateral to antennule; the large feeler.

antennal scale elongate, flattened, bladelike or finlike exopod of antenna; usually with distolateral spine.

antennular peduncle proximal 3 articles of antennule.

antennule one of first pair of appendages; movable segmented organ of sensation preceding antenna; the small feeler.

anterolateral teeth teeth on margin of carapace between orbit and lateralmost point (on crabs).

article general term for segment of appendage.

carapace dorsal and lateral shieldlike covering on cephalothorax.

carina keellike ridge or prominence.

carpus third article from distal end of a leg.

cephalothorax coalesced head and thorax.

chela arrangement of distal 2 articles of a crustacean limb in which terminal element is opposed to element preceding it in such a manner that appendage is adapted for grasping.

In a true chela, elements are shaped as fingers closing against each other.

In a subchela, terminal article (dactyl) usually closes against distal surface of penultimate article (propodus).

cheliped leg bearing a chela.

dactyl terminal or distal article of a leg or maxilliped; movable finger of a chela.

epistome a sternal plate of varying shape lying anterior to mouth between bases of antennae. In Anomura the broad epistome comes in contact with the carapace on each side; in Brachyura it becomes firmly united with the carapace.

exopod lateral ramus of a biramous appendage.

frame of mouth plates surrounding area in which mouthparts repose (in crabs); composed of fused

epistome (anterior) and ventrolateral extensions of carapace (each side) more or less thrown into ridges forming a "frame" for nested mouthparts.

front margin of carapace between eyes (in crabs).

hepatic region subtriangular, anterolateral region behind orbit.

interocular teeth teeth on frontal margin between eyes.

ischium fifth article from distal end of leg or maxilliped; usually largest article of maxilliped.

mandibles third pair of appendages; mouth parts adapted for crushing or grinding.

merus fourth article from distal end of leg or maxilliped.

orbit cavity or emargination in carapace accommodating eye; variously formed.

Commencing orbit: a stage of specialization between lack of orbit and fully formed orbit in certain spider crabs.

palm proximal portion of propodus of chela.

palp tiny accessory appendage on mandible.

pleopod swimmeret; one of biramous abdominal appendages on any except sixth segment.

pleura lateral overhanging plate on abdominal segment.

postorbital tooth - spine tooth or spine behind eye.

propodus penultimate article of leg or maxilliped.

rostrum median pointed process at anterior end of cephalothorax.

sclerotized thickened and hardened.

sternite exoskeletal plate on ventral side of body.

supraocular eave overhanging dorsal border of orbit (in certain spider crabs).

supraorbital spine spine near margin of orbit above base of eyestalk (in certain shrimps).

suture line of junction between exoskeletal plates.

telson terminal piece attached to end of sixth abdominal segment; forms, together with uropods, a tail fan.

tergum dorsal plate on abdominal segment.

third maxilliped appendage preceding first leg.

thorax central portion of body to which legs and maxillipeds attach.

uropods broad paired appendages on sixth abdominal segment; often forming, together with telson, a tail fan.

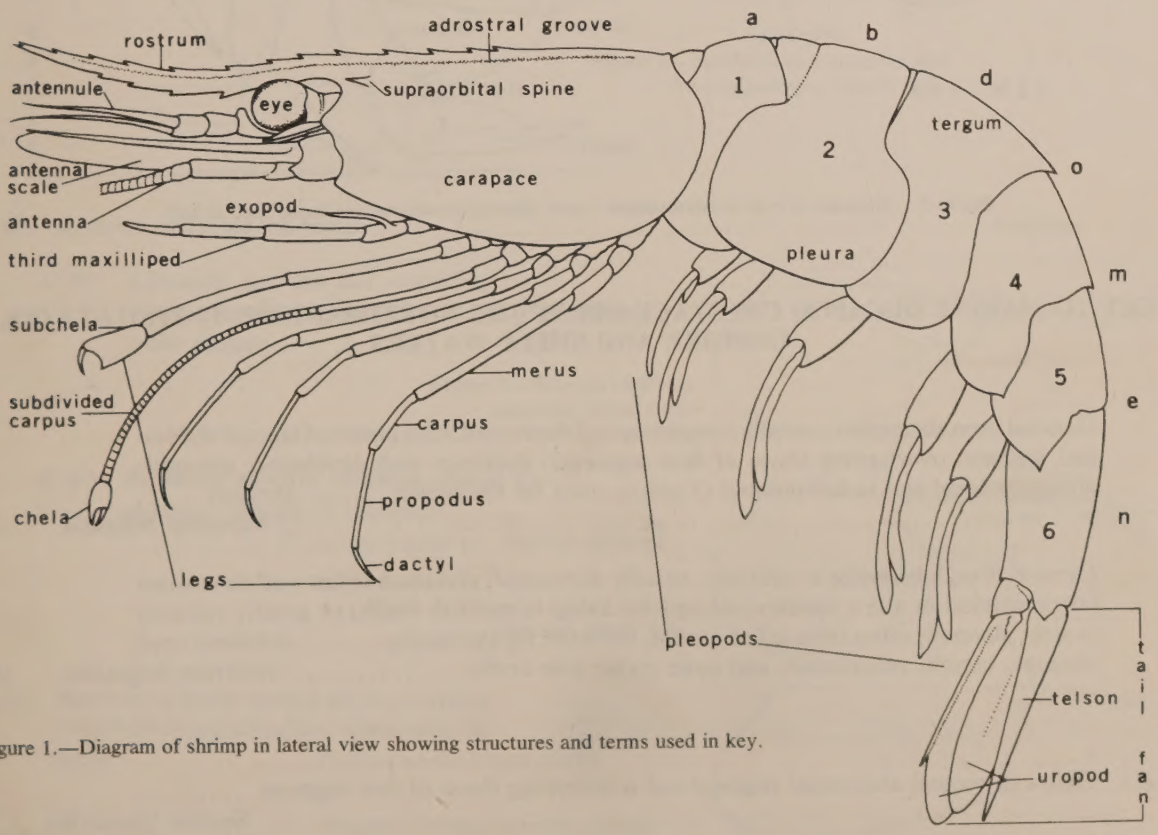


Figure 1.—Diagram of shrimp in lateral view showing structures and terms used in key.

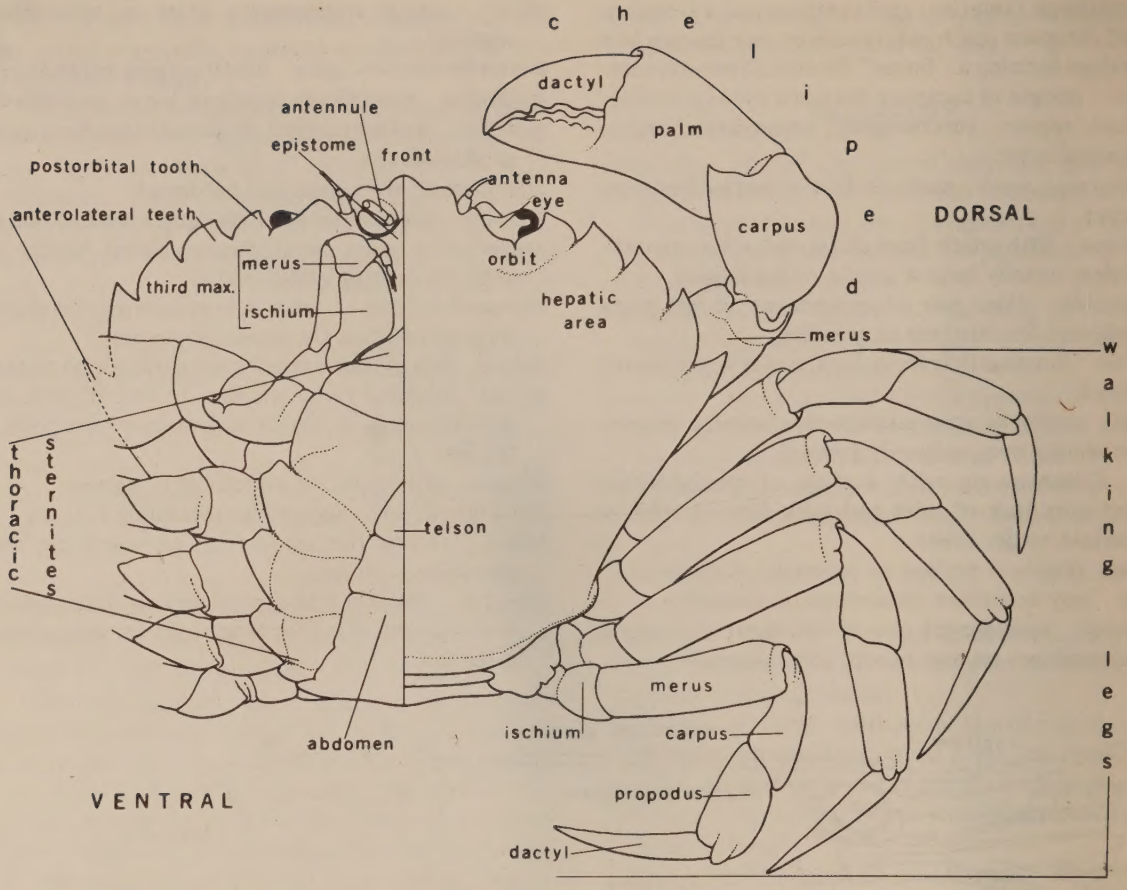


Figure 2.—Diagram of crab in dorsoventral views showing structures and terms used in key.

KEY TO MARINE DECAPOD CRUSTACEANS OF THE NORTHEASTERN UNITED STATES, INSHORE AND SHELF WATERS

1 General form shrimplike, usually compressed (if depressed, with pleura of second abdominal segment overlapping those of first segment); abdomen well developed; pleopods always present and in full number (5 pairs), used for swimming.....shrimps ..... Suborder Natantia 2

1 General form lobsterlike or crablike, usually depressed; abdomen either well developed (asymmetrical in a few species adapted for living in mollusk shells) or greatly reduced in size; pleopods often reduced or absent, not used for swimming.....lobsters; mud shrimps; hermit, porcellanid, and mole crabs; true crabs ..... Suborder Reptantia 18

2 (*1*) Pleura of second abdominal segment not overlapping those of first segment ..... Section Penaeidea 3

2 (*1*) Pleura of second abdominal segment overlapping those of first segment ..... Section Caridea 5

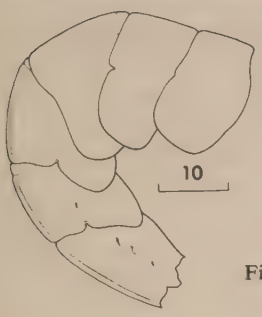


Figure 3.—Penaeidean abdomen, lateral view.

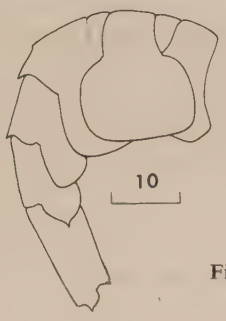


Figure 4.—Caridean abdomen, lateral view.

3 (*2*) First 3 pairs of legs chelate, all 5 pairs of legs well developed .....Family Penaeidae 4

3 (*2*) First 3 pairs of legs chelate, last 2 pairs of legs absent; slender planktonic species with head greatly elongate.....Family Sergestidae ..... *Lucifer faxoni*

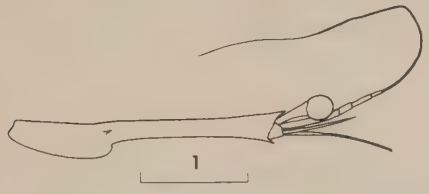


Figure 5.—*Lucifer faxoni;* carapace and head appendages, lateral view.

4 (*3*) Rostrum with ventral teeth ..... *Penaeus* A

A (*4*) Adrostral grooves not extending beyond base of rostrum ..... *P. setiferus,* white shrimp

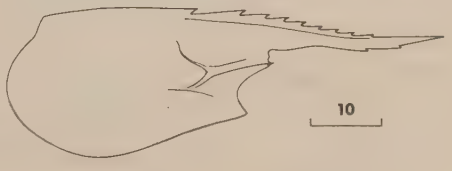


Figure 6.—*Penaeus setiferus;* carapace, lateral view.

A (*4*) Adrostral grooves reaching almost to posterior margin of carapace .... *P. aztecus aztecus,* brown shrimp

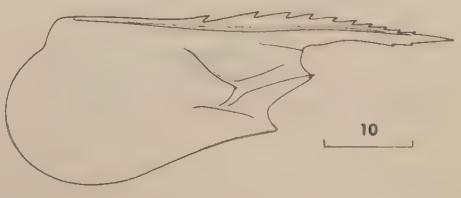


Figure 7.—*Penaeus aztecus aztecus;* carapace, lateral view.

4 (*3*) Rostrum without ventral teeth; carapace with both longitudinal and transverse sutures ..... *Parapenaeus longirostris*

Figure 8.—*Parapenaeus longirostris;* carapace, lateral view.

5 *(2)* First pair of legs chelate (minute in some species) ..... 6[2]

5 *(2)* First pair of legs subchelate (always easily visible) .....Family Crangonidae 15

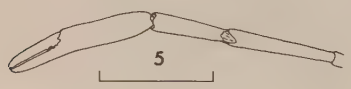


Figure 9.—Chelate leg with carpus entire.

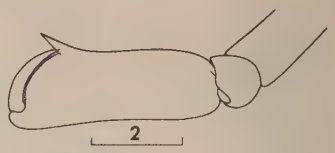


Figure 10.—Subchelate leg with carpus entire.

6 *(5)* Carpus of second pair of legs entire; first pair of legs always with well-developed chelae ..... Family Palaemonidae 7

6 *(5)* Carpus of second pair of legs subdivided into 2 or more articles 8

7 *(6)* Rostrum with 6 or more (seldom 5) ventral teeth; mandible with palp ..... *Leander tenuicornis*

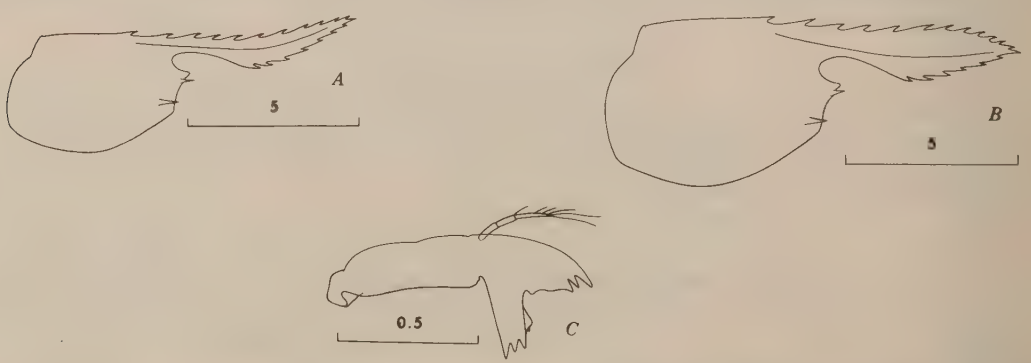


Figure 11.—*Leander tenuicornis;* A, carapace of male, lateral view; B, carapace of female, lateral view; C, mandible.

[2] *Pasiphaea multidentata* (Pasiphaeidae) with fingers of chelae on first and second legs slender, all edges comblike, is a pelagic form which occurs often enough off New England that its presence should be mentioned. Ovigerous females have a carapace length of 33 to 37 mm.

7 (6) Rostrum with no more than 5 ventral teeth, usually fewer; mandible without palp ..... *Palaemonetes* A

A (7) Rostrum with first 2 teeth of dorsal margin behind orbit, dorsal rostral teeth reaching to apex, ventral margin with 3 to 5 teeth; dactyl of second leg with 2 teeth, immovable finger with 1 on cutting edge; carpus of second leg in adult female shorter than palm, in males slightly longer or shorter (1.1 times) than palm ..... *P. vulgaris*

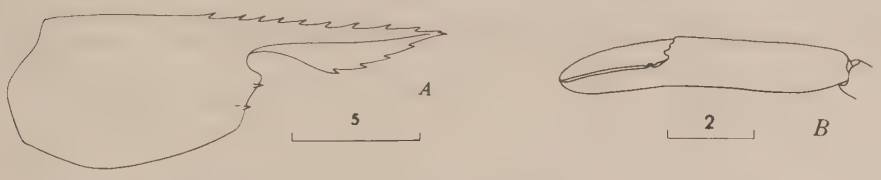


Figure 12.—*Palaemonetes vulgaris;* A, carapace, lateral view; B, chela of second leg.

A (7) Rostrum with only 1 dorsal tooth behind orbit; dactyl of second leg with single tooth or without teeth, immovable finger without teeth on cutting edge; carpus of second leg in adult female much longer than palm (1.3 to 1.5 times), in male almost as long as whole chela ..... B

B (A) Rostrum with unarmed stretch before dagger-shaped tip, ventral margin with 2 to 4, generally 3, teeth; fingers of second leg without teeth on cutting edges ..... *P. pugio*

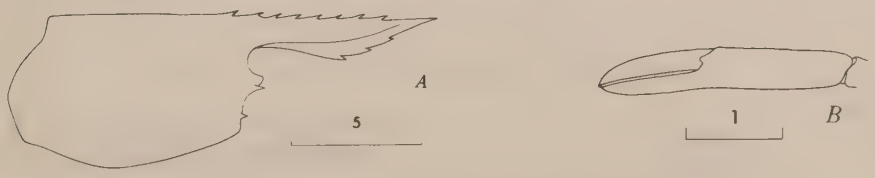


Figure 13.—*Palaemonetes pugio;* A, carapace, lateral view; B, chela of second leg.

B (A) Rostrum with dorsal teeth reaching up to often bifurcated apex, ventral margin with 4 or 5 (seldom 3) teeth; dactyl of second leg with 1 distinct tooth on cutting edge ..... *P. intermedius*

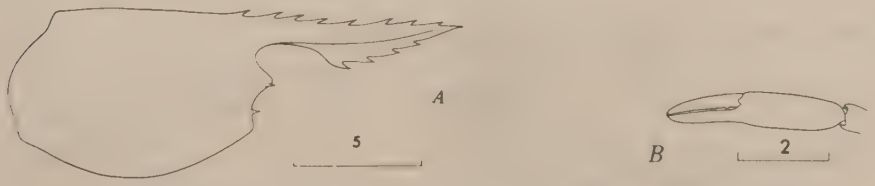


Figure 14.—*Palaemonetes intermedius;* A, carapace, lateral view; B, chela of second leg.

8 (6) Chelae of first pair of legs distinct ..... Family Hippolytidae 9

8 (6) Chelae of first pair of legs microscopic or absent ..... Family Pandalidae 14

9 (8) Carpus of second leg divided into 3 articles 10

9 (8) Carpus of second leg divided into 7 articles (proximal to distal, 2 short, 1 long, 4 short) 12

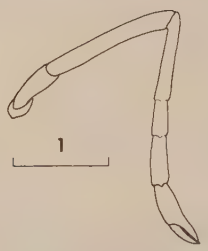


Figure 15.—Second leg with subdivided carpus, 3 articles.

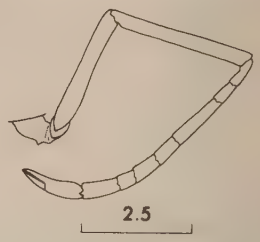


Figure 16.—Second leg with subdivided carpus, 7 articles.

10 (9) Without series of small spines on anterior margin of carapace below eye 11

10 (9) A series of small spines (5 to 9) along anterior margin of carapace below eye ..... *Latreutes fucorum*

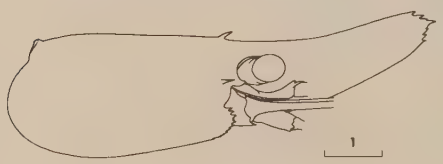


Figure 17.—*Latreutes fucorum;* carapace and head appendages, lateral view.

11 (10) Rostrum considerably less than twice length of carapace proper and with both dorsal and ventral teeth ..... *Hippolyte* A

A (11) Tip of rostrum not exceeding antennular peduncle ..... *H. pleuracanthus*

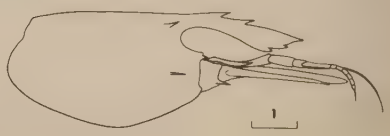


Figure 18.—*Hippolyte pleuracanthus;* carapace and head appendages, lateral view.

A *(11)* Tip of rostrum obviously exceeding antennular peduncle ..... *H. zostericola*

Figure 19.—*Hippolyte zostericola;* carapace and antennule, lateral view.

11 *(10)* Rostrum nearly twice length of carapace proper, smooth above, toothed on ventral margin ..... *Tozeuma carolinense*

Figure 20.—*Tozeuma carolinense;* carapace, lateral view.

12 (9) Supraorbital spines present 13

12 (9) Supraorbital spines absent ..... *Eualus* A

A *(12)* Tip of rostrum usually not reaching distal edge of eye (rarely exceeding eye) ..... *E. pusiolus*

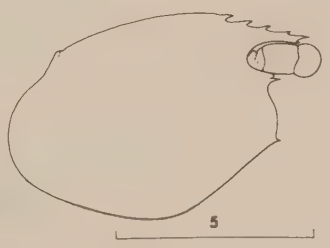


Figure 21.—*Eualus pusiolus;* carapace and eye, lateral view.

A *(12)* Tip of rostrum greatly exceeding distal edge of eye ..... B

B *(A)* Rostrum slender, toothed dorsally throughout length ..... *E. gaimardii*

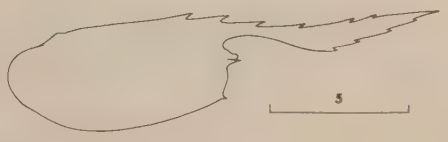


Figure 22.—*Eualus gaimardii;* carapace, lateral view.

B *(A)* Rostrum lacking dorsal teeth on distal part beyond eye ..... *E. fabricii*

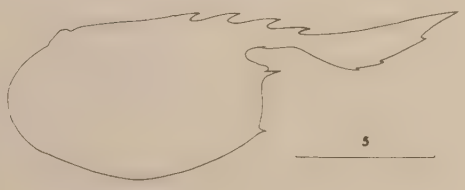


Figure 23.—*Eualus fabricii;* carapace, lateral view.

13 (*12*) Carapace with 2 or more supraorbital spines on each side; third maxilliped with exopod ..... *Spirontocaris* A

A (*13*) Dorsal teeth extending to, or beyond, posterior third of carapace ..... B

A (*13*) Dorsal teeth falling short of posterior third of carapace ..... *S. phippsii*

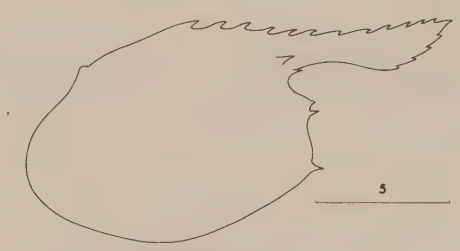


Figure 24.—*Spirontocaris phippsii;* carapace, lateral view.

B (*A*) Ventral margin of rostrum with 4 to 6 teeth; tip ascending to a well-defined single point ..... *S. liljeborgii*

Figure 25.—*Spirontocaris lilljeborgii;* carapace, lateral view.

B (*A*) Ventral margin of rostrum with about 2 (occasionally 3) large teeth and variable number of smaller ones (none to many); tip single or double and often almost equalled or surpassed by distalmost ventral tooth ..... *S. spinus*

Figure 26.—*Spirontocaris spinus;* carapace, lateral view; A, B, two examples of variation in rostral tooth pattern.

3 (*12*) Carapace with 1 supraorbital spine on each side; third maxilliped without exopod ..... *Lebbeus* A

A (*13*) Four prominent spines along middorsal line of carapace ..... *L. groenlandicus*

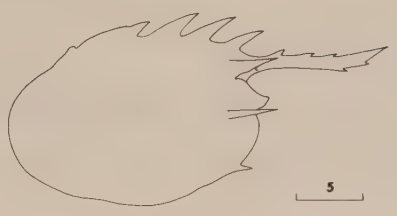


Figure 27.—*Lebbeus groenlandicus;* carapace, lateral view.

A (*13*) No more than 2 spines along dorsal line of carapace ..... B

B (*A*) Rostrum long, tip exceeding proximal article of antennular peduncle in juveniles and entire peduncle in adults ..... *L. polaris*

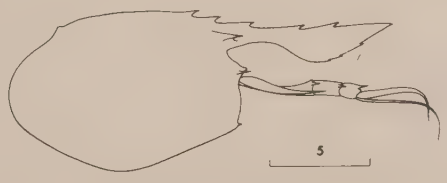


Figure 28.—*Lebbeus polaris;* carapace and antennule, lateral view of adult.

B (*A*) Rostrum short, tip not exceeding proximal article of antennular peduncle (body conspicuously banded) ..... *L. zebra*

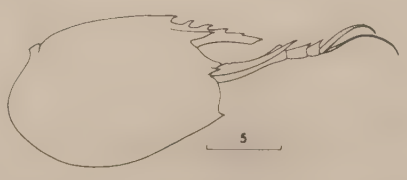


Figure 29.—*Lebbeus zebra;* carapace and antennule, lateral view.

14 (*8*) Third maxillipeds with exopod ..... *Dichelopandalus leptoceras*

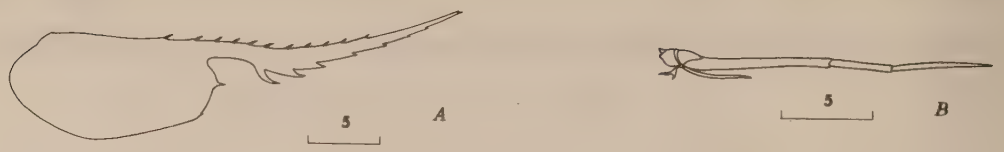


Figure 30.—*Dichelopandalus leptoceras;* A, carapace, lateral view; B, third maxilliped showing slender simple exopod at base.

14 (*8*) Third maxillipeds without exopod ..... *Pandalus* A

A (*14*) Abdomen with small median spine on posterior edge of third and fourth segments ..... *P. borealis*

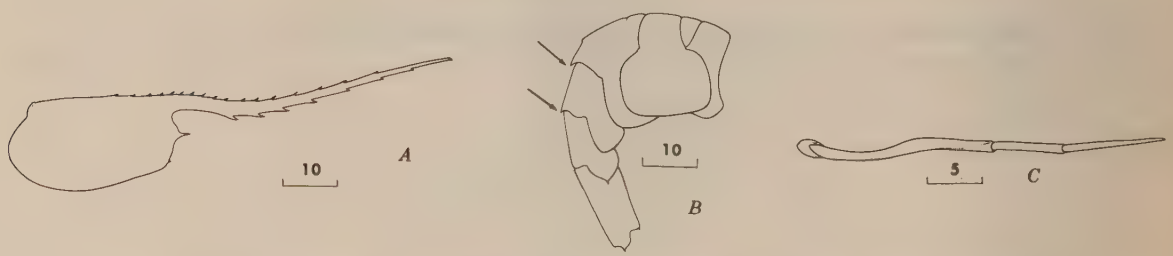


Figure 31.—*Pandalus borealis;* A, carapace, lateral view; B, abdomen, lateral view; C, third maxilliped.

A (*14*) Abdomen with no median spines on segments ..... B

B (*A*) Distolateral spine of antennal scale exceeding extremely narrowed blade; rostrum upturned at about 45° angle ..... *P. propinquus*

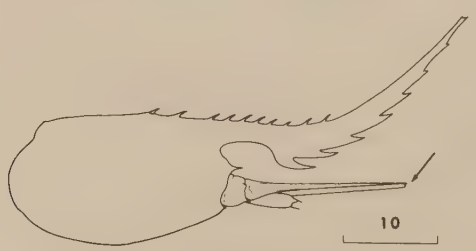


Figure 32.—*Pandalus propinquus;* carapace and antennal scale, lateral view.

B *(A)* Distolateral spine of antennal scale not exceeding somewhat narrowed blade; rostrum upturned at considerably less than 45° angle ..... *P. montagui*

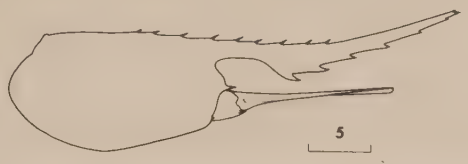
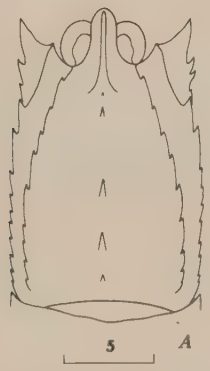


Figure 33.—*Pandalus montagui;* carapace and antennal scale, lateral view.

15 *(5)* Second legs slender and chelate 16

15 *(5)* Second legs reduced and simple, not chelate ..... *Sabinea* A

A *(15)* Rostrum with rounded tip hardly exceeding eyes; telson with narrow but truncate tip bearing 8 or more spines or stout setae ..... *S. septemcarinata*



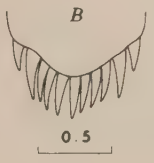


Figure 34.—*Sabinea septemcarinata;* A, carapace and eyes, dorsal view; B, tip of telson.

A *(15)* Rostrum with acute tip reaching beyond eyes; telson ending in sharp tip flanked by 1 or 2 spines on each side ..... *S. sarsii*

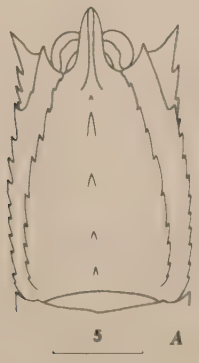


Figure 35.—*Sabinea sarsii;* A, carapace and eyes, dorsal view; B, tip of telson.

16 *(15)* Second legs almost as long as other legs 17

16 *(15)* Second legs much shorter than other legs ..... *Pontophilus* A

A *(16)* Tip of rostrum reaching about to distal edge of eyes ..... *P. norvegicus*

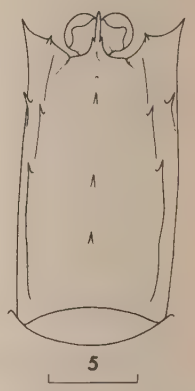


Figure 36.—*Pontophilus norvegicus;* carapace and eyes, dorsal view.

A *(16)* Tip of rostrum falling far short of distal edge of eyes ..... *P. brevirostris*

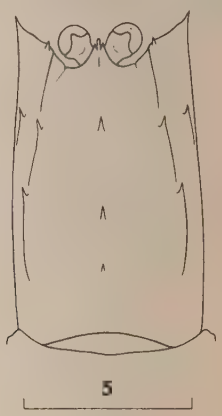


Figure 37.—*Pontophilus brevirostris;* carapace and eyes, dorsal view.

17 *(16)* Body neither heavily sclerotized nor sculptured ..... *Crangon septemspinosa*

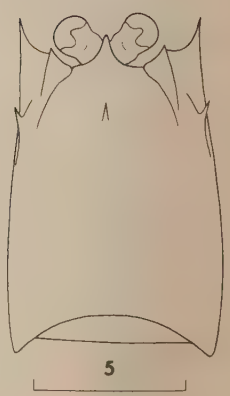


Figure 38.—*Crangon septemspinosa;* carapace and eyes, dorsal view.

17 *(16)* Body heavily sclerotized and sculptured ..... *Sclerocrangon boreas*

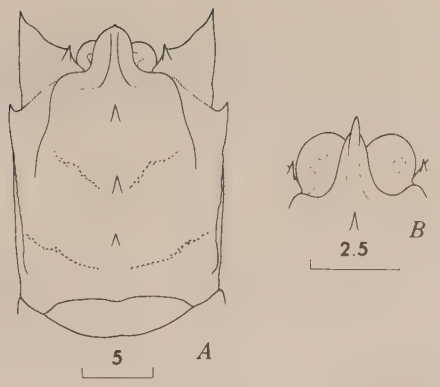
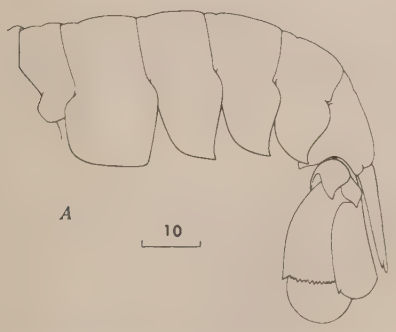


Figure 39.—*Sclerocrangon boreas;* A, carapace and eyes, dorsal view of adult; B, rostrum and eyes of juvenile.

18 *(1)* Abdomen extended, symmetrical, pleura sometimes, and tail fan always well developed ..... Section Macrura 19

18 *(1)* Abdomen bent upon itself or flexed beneath thorax; pleura usually small or absent; tail fan variable in development; third legs unlike first, never chelate 24

19 *(18)* Abdomen well armed, pleura well developed; third legs chelate like first ....Superfamily Astacidea, Family Nephropsidae, *Homarus americanus,* American lobster



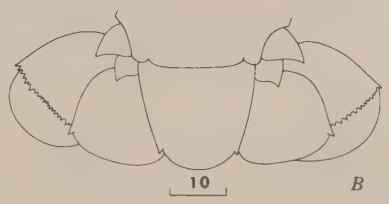


Figure 40.—*Homarus americanus;* A, abdomen and tail fan, lateral view; B, tail fan, dorsal view.

19 *(18)* Abdomen more or less membranous, pleura small or absent; third legs unlike first, never chelate.....Superfamily Thalassinidea, mud shrimps 20

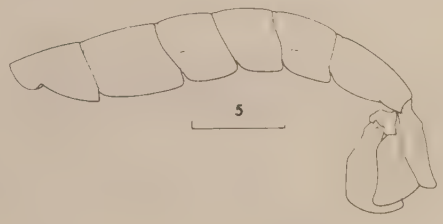


Figure 41.—Abdomen and tail fan of mud shrimp, lateral view.

20 *(19)* First legs subchelate, dactyls folding to reflexed position when closed ...Family Laomediidae, *Naushonia crangonoides*

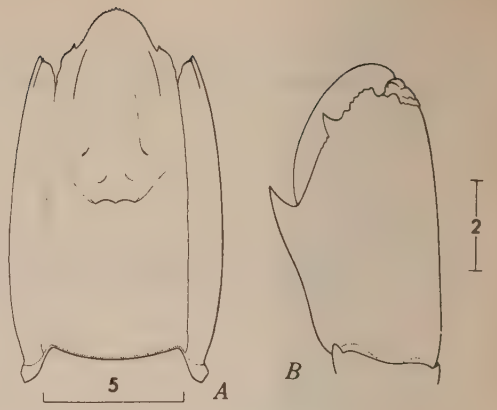


Figure 42.—*Naushonia crangonoides;* A, carapace, dorsal view; B, subchela of first leg.

20 *(19)* First legs either chelate or approaching subchelate condition, but never with dactyls folding to reflexed position when closed 21

21 *(20)* Rostrum prominent, extending beyond eyes 22

21 *(20)* Rostrum short; flattened, pointed eyes fully exposed.....Family Callianassidae ..... *Callianassa atlantica*

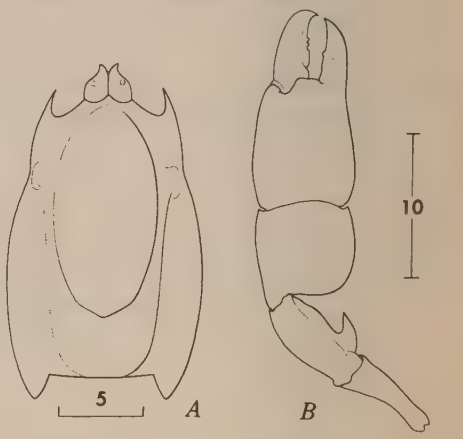


Figure 43.—*Callianassa atlantica;* A, carapace and eyes, dorsal view; B, major chela of male.

22 *(21)* Rostrum hairy and nearly flat, few teeth along sides, flanked on each side by large spine ....Family Upogebiidae, *Upogebia affinis*

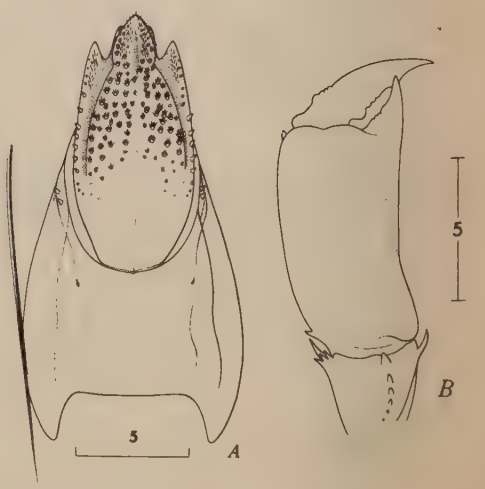


Figure 44.—*Upogebia affinis;* A, carapace, dorsal view; B, chela.

22 *(21)* Rostrum hairless, evenly toothed along sides and with median low carina ..... Family Axiidae 23

Figure 45.—Carapace of an axiid, dorsal view.

23 *(22)* Eyes normal with pigmented, rounded cornea; outer blade of uropods lacking transverse suture distally ..... *Axius serratus*

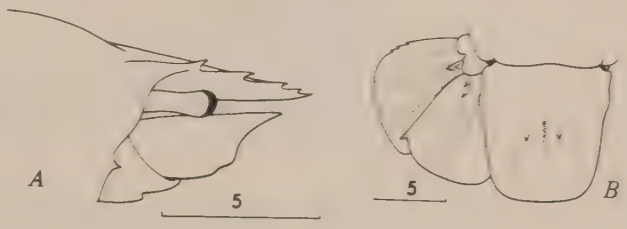


Figure 46.—*Axius serratus;* A, ocular region, lateral view; B, portion of tail fan, dorsal view.

23 *(22)* Eyes lacking pigment, flattened obliquely on distal surface; outer blade of uropods with transverse suture distally ..... *Calocaris templemani*

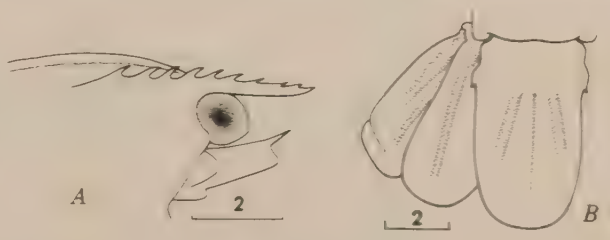


Figure 47.—*Calocaris templemani;* A, ocular region, lateral view; B, portion of tail fan, dorsal view.

24 *(18)* Abdomen variously developed and with uropods present; or with uropods absent and only 4 pairs of well-developed legs visible; carapace not apparently fused with epistome .....Section Anomura, hermit crabs, porcellanids, mole crabs, and lithodids 25

24 *(18)* Abdomen permanently flexed beneath thorax; uropods absent and 5 pairs of legs visible; carapace fused with epistome.....Section Brachyura, true crabs 30

25 (24) Abdomen well developed, symmetrical or asymmetrical 26

25 (24) Abdomen reduced in size, symmetrical and flexed under thorax .....
.....Superfamily Hippidea, Family Hippidae, *Emerita talpoida,* mole crab

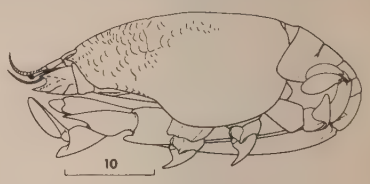


Figure 48.—*Emerita talpoida,* lateral view.

26 (25) Abdomen symmetrical (or superficially so), more or less flexed beneath thorax; thorax depressed and crablike.....Superfamily Galatheidea 27

26 (25) Abdomen asymmetrical, tail fan reduced and adapted for holding body in mollusk shells.....Superfamily Paguroidea, Family Paguridae, *Pagurus*, hermit crabs..... A

A (26) Palm of small (left) chela roughly oval in cross section, upper surface flattened, not divided by a ridge ..... B

A (26) Palm of small (left) chela triangular in cross section, upper surface divided by longitudinal ridge into 2 obliquely sloping facets ..... E

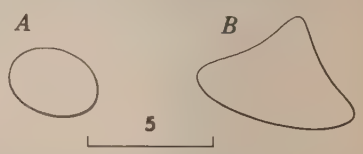


Figure 49.—Cross sections of pagurid palm (propodus); A, oval; B, triangular.

B (A) Cornea of eye dilated, length of eyestalks not more than 3.5 times greatest width C

B (A) Cornea not dilated, length of eyestalks at least 4 times greatest width (small species)..... *P. annulipes*

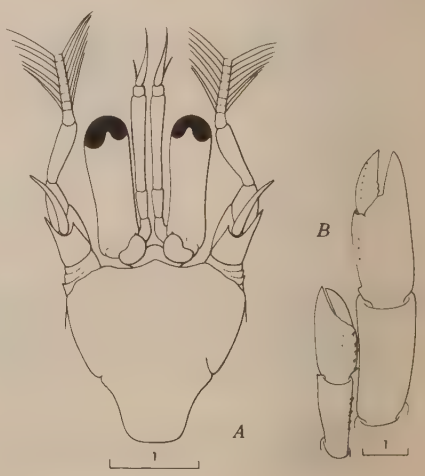


Figure 50.—*Pagurus annulipes;* A, anterior part of body; B, chelae and carpi, dorsal views.

C *(B)* Both chelipeds slender, subcylindrical, relatively smooth or lightly granulate (small species) ..... *P. longicarpus*

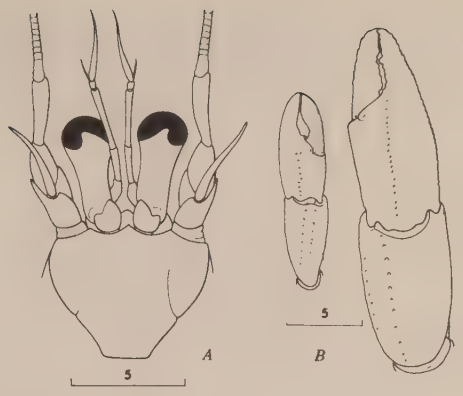


Figure 51.—*Pagurus longicarpus;* A, anterior part of body; B, chelae and carpi, dorsal views.

C *(B)* Both chelipeds stout; conspicuously broad and smooth, or sharply spined ..... D

D *(C)* Dactyl of major chela with sharply produced angle on mesial margin; upper surface of both chelae sharply but evenly granulated ..... *P. pollicaris*

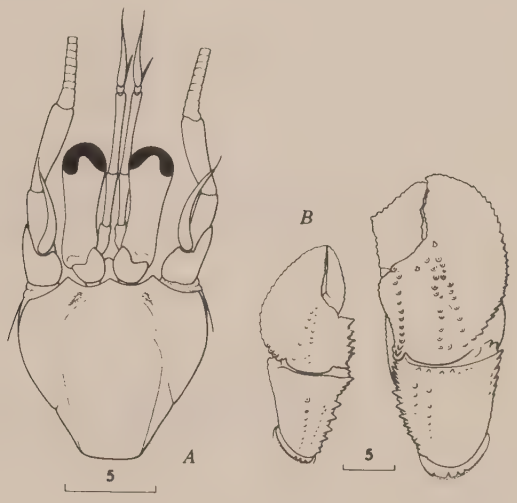


Figure 52.—*Pagurus pollicaris;* A, anterior part of body; B, chelae and carpi, dorsal views.

D *(C)* Dactyl of major chela with no sharply produced angle on mesial margin, border usually spiny; upper surface of both chelae covered with short, sharp spines, and often with broad longitudinal red-orange stripe persistent in alcohol ..... *P. acadianus*

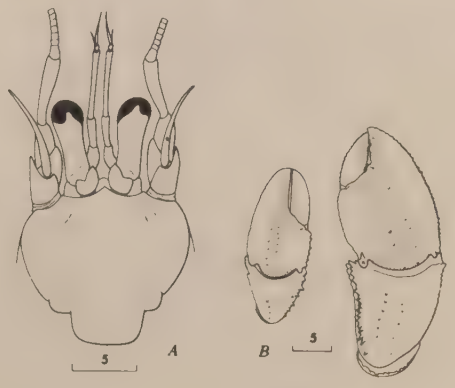


Figure 53.—*Pagurus acadianus;* A, anterior part of body; B, chelae and carpi, dorsal views.

E *(A)* Palm of small (left) chela with conspicuous longitudinal ridge crested with single row of elevated sharp principal spines slanted inward; anterior portion of sternite between third legs somewhat rectangular (almost twice as wide as long), setae few and short. (Usually occurs offshore.) ..... *P. pubescens*

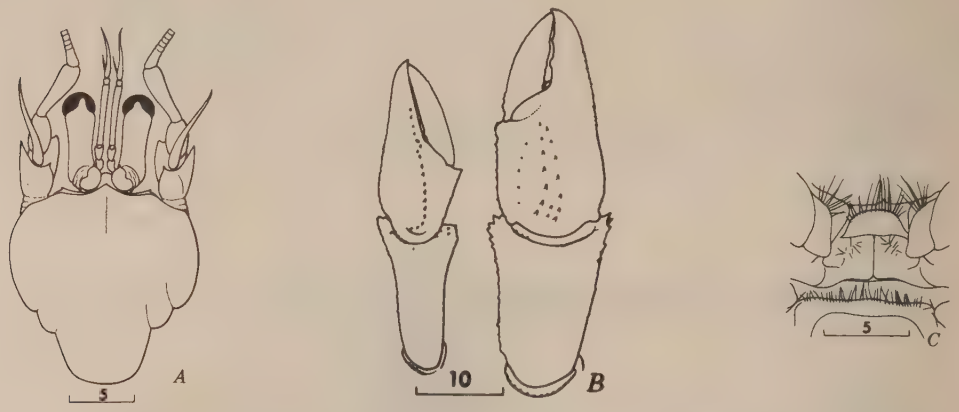


Figure 54.—*Pagurus pubescens;* A, anterior part of body; B, chelae and carpi, dorsal views; C, sternite between third legs, ventral view.

E *(A)* Palm of small (left) chela with broad longitudinal ridge crested with sharp or blunt spines (tending to form double row) not slanted inward ..... F

F *(E)* Chelipeds both sharply spined and hairy on upper surfaces; anterior portion of sternite between third legs almost semicircular (nearly as long as broad), setae many and long. (Usually occurs inshore.) ..... *P. arcuatus*

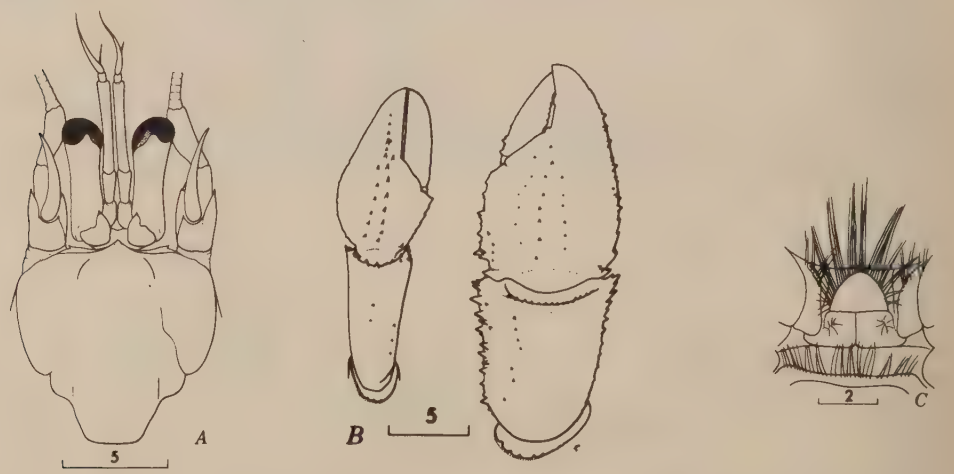


Figure 55.—*Pagurus arcuatus;* A, anterior part of body; B, chelae and carpi, dorsal views; C, sternite between third legs, ventral view.

F (*E*) Chelipeds bluntly spined (occasionally sharply) but not hairy on upper surfaces. (Occurs in deep water offshore.) ..... *P. politus*

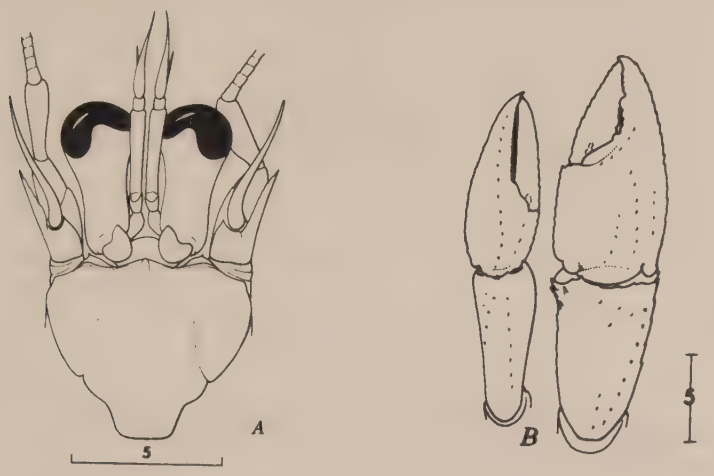


Figure 56.—*Pagurus politus;* A, anterior part of body; B, chelae and carpi, dorsal views.

27 *(26)* Tail fan well developed 28

27 *(26)* Tail fan lacking, uropods absent; fifth legs hidden making only 4 pairs of legs apparent ..... Family Lithodidae, *Lithodes maja*

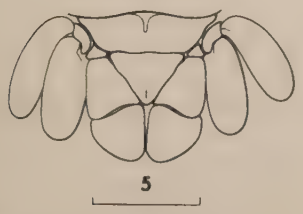


Figure 57.—Well-developed tail fan of porcellanid crab, dorsal view.

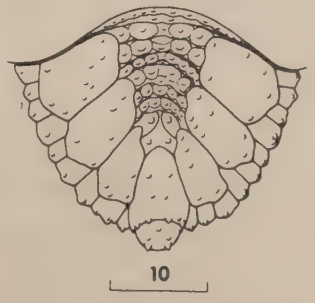


Figure 58.—*Lithodes maja,* terminal portion of abdomen.

28 *(27)* Form somewhat lobsterlike; rostrum long and narrow.....Family Galatheidae, *Munida* .. A

A *(28)* Second (apparent first) abdominal segment armed with tiny anterior spines ..... *M. iris*

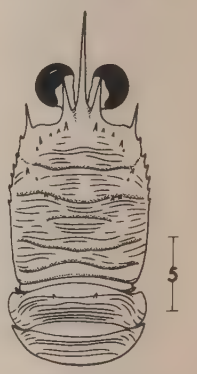


Figure 59.—*Munida iris*, dorsal view with abdomen flexed.

A *(28)* Both second (apparent first) and third abdominal segments armed with series of tiny anterior spines (a large species) ..... *M. valida*

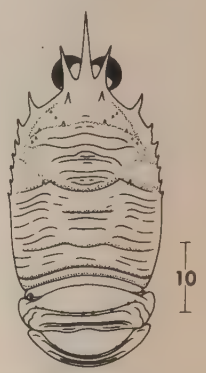


Figure 60.—*Munida valida*, dorsal view with abdomen flexed.

28 *(27)* Form crablike; rostrum short and broad or absent.....Family Porcellanidae 29

29 *(28)* Carapace distinctly broader than long, front smooth in dorsal view ..... *Polyonyx gibbesi*

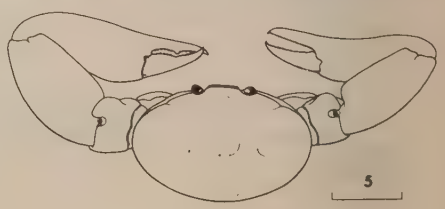


Figure 61.—*Polyonyx gibbesi*, carapace and chelae.

29 *(28)* Carapace longer than broad, front strongly tridentate in dorsal view ..... *Porcellana sigesbiana*

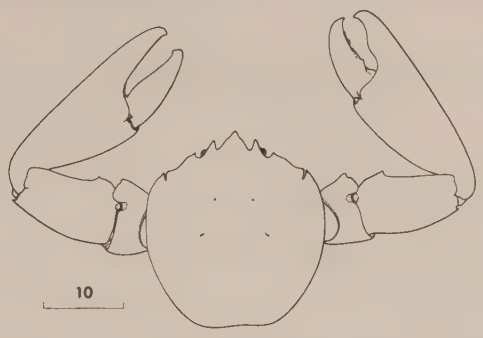


Figure 62.—*Porcellana sigesbiana;* carapace, and chelae (twisted to show tooth pattern).

30 *(24)* Frame of mouth elongate and triangular, sides converging anteriorly .....
..... Subsection Oxystomata 31

30 *(24)* Frame of mouth either rectangular (prolonged in certain swimming crabs) with sides parallel, or transversely somewhat ellipsoid or kidney shaped 33

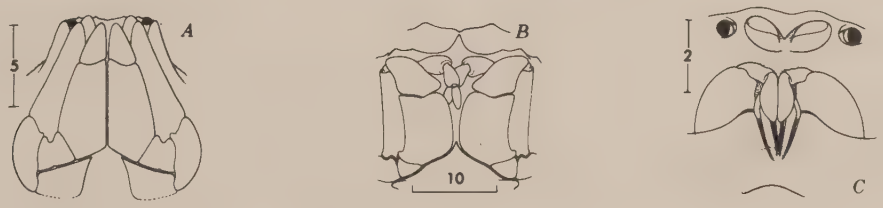


Figure 63.—Brachyuran mouth frames; A, triangular; B, rectangular; C, kidney-shaped or transversely ellipsoid.

31 *(30)* Carapace very short, exposing first 2 or 3 abdominal terga in dorsal view; front with 2 bifid (appear as 4) laminar teeth.....Family Dorippidae ..... *Ethusa microphthalma*

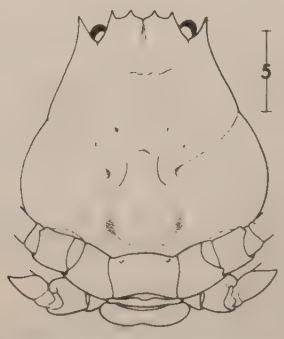


Figure 64.—*Ethusa microphthalma,* portion of body in dorsal view.

31 *(30)* Carapace not so short, exposing little if any of abdomen in dorsal view 32

32 (*31*) Body hemispherical .....Family Leucosiidae: *Persephona aquilonaris*

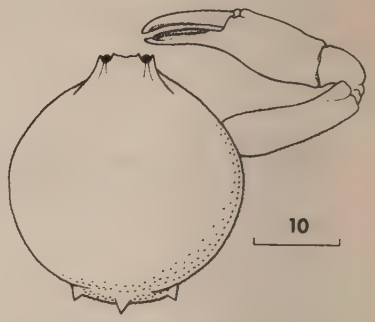


Figure 65.—*Persephona aquilonaris;* carapace and eyes, right cheliped.

32 (*31*) Body longer than broad; each cheliped with greatly extended lateral spine on merus ..... Family Calappidae: *Acanthocarpus alexandri*

Figure 66.—*Acanthocarpus alexandri;* carapace and eyes, chelipeds.

33 (*30*) Body elongate rectangular in dorsal view; last pair of legs permanently folded over back; first pleopods present in female .... Subsection Dromiacea, Family Homolidae: *Homola barbata*

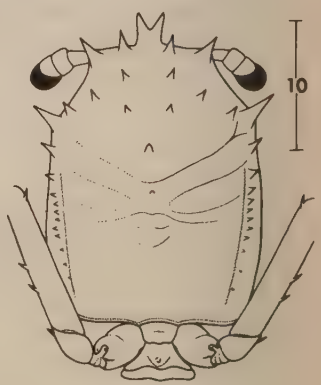


Figure 67.—*Homola barabata;* dorsal view, portion of body and insertion of last pair of legs.

33 (*30*) Body never elongate rectangular in dorsal view; last pair of legs not permanently folded over back; first pleopods lacking in female .....Subsection Brachygnatha 34

34 (*33*) Body conspicuously narrowed in front; rostrum usually distinct and often forked; orbits often incomplete.....Superfamily Oxyrhyncha, spider crabs.....35

34 (*33*) Body moderate to broad in front; rostrum absent or greatly reduced; orbits usually complete .....Superfamily Brachyrhyncha 41

35 (*34*) Chelipeds not much larger than other legs .....Family Majidae 36

35 (*34*) Chelipeds very much larger than other legs .....Family Parthenopidae 40

36 (*35*) Whole length of rostral horns either coalesced or closely approximated along midline; male abdomen terminally broadened, telson elliptical to subquadrate..... Subfamily Oregoniinae, *Hyas* ..... A

A (*36*) Hepatic region behind postorbital spine not expanded .....*H. araneus*

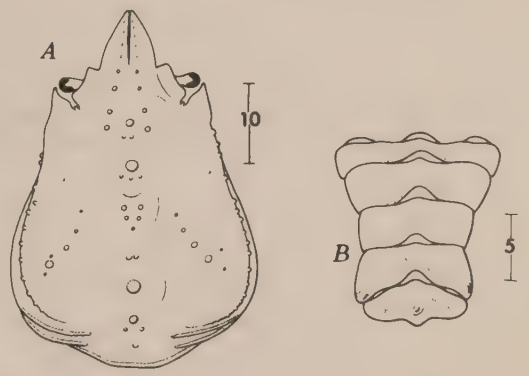


Figure 68.—*Hyas araneus;* A, carapace and eyes; B, male abdomen.

A (*36*) Hepatic region behind postorbital spine expanded laterally .....*H. coarctatus*

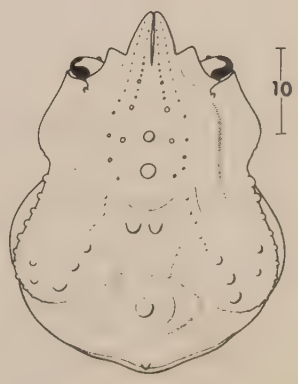


Figure 69.—*Hyas coarctatus,* carapace and eyes.

36 (*35*) Rostral horns divergent near tip; male abdomen not terminally broadened, telson subtriangular 37

Figure 70.—Male abdomen of spider crab with subtriangular telson.

37 *(36)* Eyes without orbits; eyestalks retractile against acute postocular spine, affording no concealment; proximal (fused) antennal article extremely slender (viewed ventrally) ..... Subfamily Inachinae 38

37 *(36)* Eyes with commencing orbits, each composed of cupped postocular process into which eye retracts, and supraocular eave; proximal (fused) antennal article not extremely slender (viewed ventrally) ..... Subfamily Pisinae 39

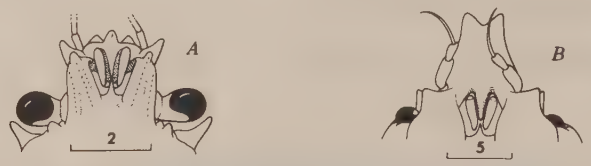


Figure 71.—Orbital areas of spider crabs in ventral view; A, Inachinae; B, Pisinae.

38 *(37)* Fused proximal article of antenna terminating in single blunt spine. [Rathbun (1925) recognized New England form as subspecies *marthae*.] ..... *Euprognatha rastellifera*

Figure 72.—*Euprognatha rastellifera*, portion of body in dorsal view.

38 *(37)* Fused proximal article of antenna with compound lateral spines ..... *Collodes robustus*

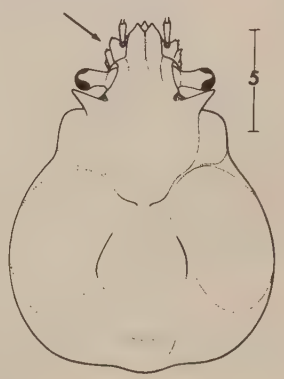


Figure 73.—*Collodes robustus*, portion of body in dorsal view.

39 (*37*) Supraocular eave and postocular process touching or somewhat overlapping ..... *Libinia* A

A (*39*) Median line of carapace with about 9 spines and/or spiniform tubercles .... *L. emarginata*

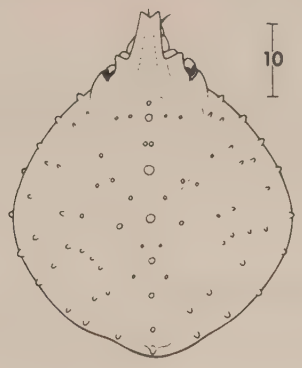


Figure 74.—*Libinia emarginata*, portion of body in dorsal view.

A (*39*) Median line of carapace with about 6 spines and/or spiniform tubercles ..... *L. dubia*

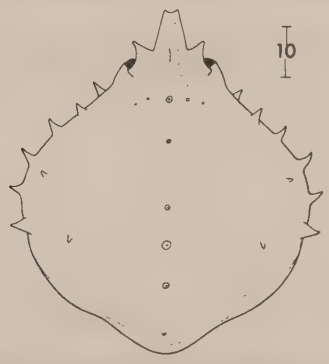


Figure 75.—*Libinia dubia*, carapace and eyes.

39 (*37*) Supraocular eave and postocular spine or process clearly separated (small, smooth, rounded, pubescent species) ..... *Pelia mutica*

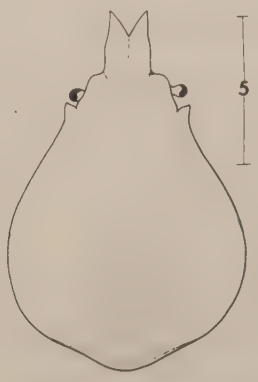


Figure 76.—*Pelia mutica*, carapace and eyes.

40 (*35*) Carapace not laterally expanded over walking legs; unevenly spinose .... *Parthenope pourtalesii*

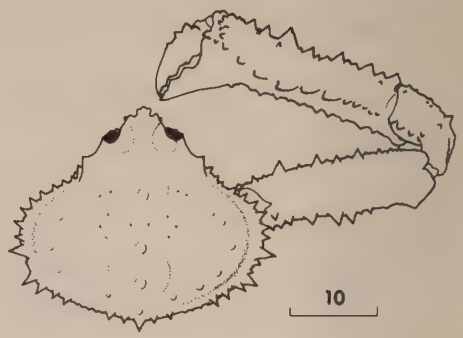


Figure 77.—*Parthenope pourtalesii*, carapace and right cheliped.

40 (*35*) Carapace more or less laterally expanded forming a vault overlying and concealing walking legs; nearly smooth ..... *Heterocrypta granulata*

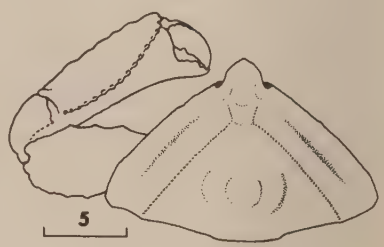


Figure 78.—*Heterocrypta granulata*, carapace and left cheliped.

41 (*34*) Body round or transversely ellipsoid 42

41 (*34*) Body quadrate; squared and broadest in front, occasionally somewhat narrowed and rounded 58

42 (*41*) Free living crabs with parallel sided mouth frame 43

42 (*41*) Small, usually commensal crabs with reduced eyes; adult females often with carapace somewhat membranous; mouth frame transversely somewhat ellipsoid or kidney shaped .....Family Pinnotheridae 56

43 (*42*) Legs (especially last pair) more or less flattened for swimming .....Family Portunidae 44

43 (*42*) Legs not flattened for swimming 49

44 (*43*) Carapace with 5 teeth on anterolateral margin 45

44 (*43*) Carapace with 9 teeth on anterolateral margin 47

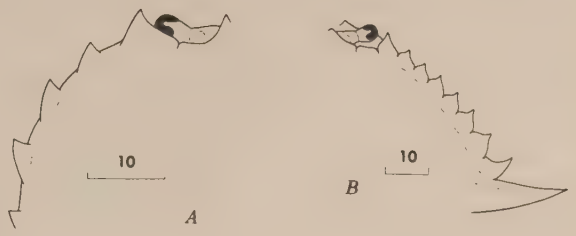


Figure 79.—Anterolateral border of portunid carapace; A, 5 teeth; B, 9 teeth.

45 (*44*) Distal articles of fifth legs not paddlelike ..... *Carcinus maenas*

45 (*44*) Distal articles of fifth legs paddlelike 46

Figure 80.—Fifth leg of portunid crab; A, not paddlelike; B, paddlelike.

46 (*45*) Anterolateral teeth similar; dactyl of swimming paddles broadly oval; male abdomen oblong ..... *Ovalipes ocellatus*

Figure 81.—*Ovalipes ocellatus*, carapace and eyes.

46 (*45*) Anterolateral teeth dissimilar, fifth an elongate lateral spine; dactyl of swimming paddle broadly pointed; male abdomen triangular ..... *Bathynectes superbus*

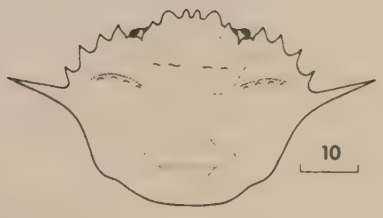


Figure 82.—*Bathynectes superbus*, carapace and eyes.

47 (*44*) Carpus with mesiodistal spine; abdomen of male triangular 48

47 (*44*) Carpus without mesiodistal spine; abdomen of male T-shaped ..... *Callinectes* A

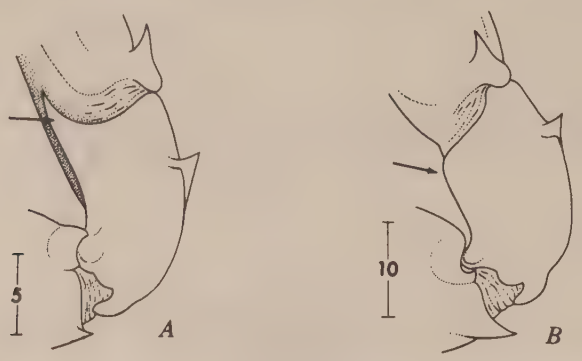


Figure 83.—Carpus of portunid right cheliped; A, *Portunus;* B, *Callinectes.*

A (*47*) Front with 2 prominent, broad based, contiguous, triangular teeth between inner orbitals; frontal teeth occasionally with rudimentary submesial teeth on inner slopes ..... *C. sapidus*

Figure 84.—*Callinectes sapidus,* frontal and orbital regions.

A (*47*) Front with 2 prominent teeth between inner orbitals separated by flattened space bearing pair of rudimentary submesial teeth ..... *C. similis*

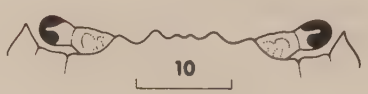


Figure 85.—*Callinectes similis,* frontal and orbital regions.

48 (*47*) Front with 2 bifurcated teeth between inner orbitals; fissures on orbital margin broadly open; color light brown, thickly covered over dorsal surface with small white spots, reticulate pattern persisting in alcohol ..... *Arenaeus cribrarius*

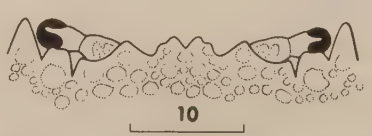


Figure 86.—*Arenaeus cribrarius,* frontal and orbital regions.

48 (47) Front with 4 separate teeth between inner orbitals; fissures on orbital margin closed except for shallow notch; color varied but never as above ..... *Portunus* A

A (48) Carapace nearly devoid of ridges and without noticeable short thick covering of hairs ..... *P. sayi*

Figure 87.—*Portunus sayi*, carapace and eyes.

A (48) Carapace with ridges fairly prominent and with noticeable covering of short thick hairs ..... B

B (A) Lateral spine relatively short, not more than about twice length of preceding tooth; a number of meandering ridges on carapace ..... *P. spinimanus*

Figure 88.—*Portunus spinimanus*, carapace and eyes.

B (A) Lateral spine long, obviously more than twice length of preceding tooth; a single ridge (often darkened) leading to lateral spine on each side of carapace ..... *P. gibbesii*

Figure 89.—*Portunus gibbesii*, carapace and eyes.

49 *(43)* Front with median tooth; antennules folding longitudinally.....Family Cancridae, *Cancer* ... A

Figure 90.—*Cancer;* A, frontal and orbital regions; B, antennules folded longitudinally.

A *(49)* Anterolateral teeth of carapace with margins granulate; chelipeds granulate, not denticulate ..... *C. irroratus*

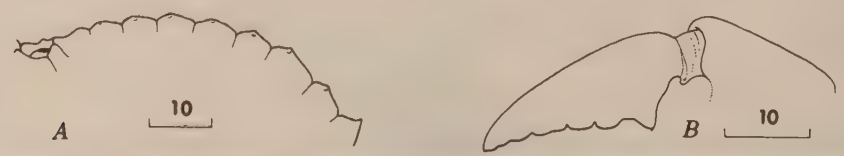


Figure 91.—*Cancer irroratus;* A, right anterolateral border; B, dactyl and upper border of chela.

A *(49)* Anterolateral teeth of carapace with denticulate margins; upper margin of palm denticulate ..... *C. borealis*

Figure 92.—*Cancer borealis;* A, right anterolateral border; B, dactyl and upper border of chela.

49 *(43)* Front lacking median tooth; antennules folding transversely or obliquely 50

50 *(49)* Body transversely oval; fifth anterolateral tooth not enlarged and spinelike; legs not extremely long and slender (occur in shallow water) ..... Family Xanthidae 51

50 *(49)* Body nearly as long as broad; fifth anterolateral tooth enlarged into lateral spine (blunt in adult); legs extremely long and slender; (usually occurs beyond continental shelf) ..... Family Geryonidae, *Geryon quinquedens*

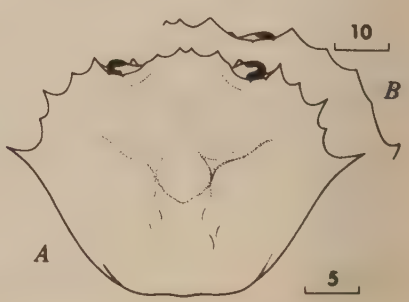


Figure 93.—*Geryon quinquedens;* A, carapace and eyes of young; B, orbital and anterolateral border of adult.

51 (*50*) Extreme edge of frontal margin with shallow transverse groove (under magnification) ..... *Rhithropanopeus harrisii*

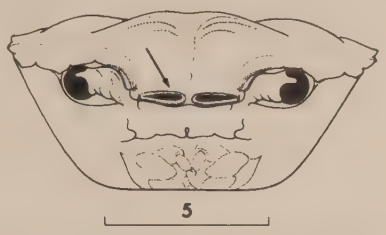


Figure 94.—*Rhithropanopeus harrisii*, frontal view of body showing transversely grooved front.

51 (*50*) Extreme edge of frontal margin not transversely grooved, each half presenting single edge (under magnification) 52

52 (*51*) Major chela with a more or less conspicuous tooth at base of dactyl, tooth often of contrasting color 53

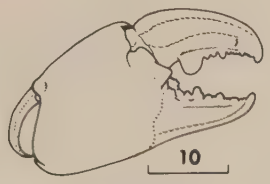


Figure 95.—Xanthid major chela with large basal tooth on dactyl.

52 (*51*) Major chela with no tooth at base of dactyl, or with obsolescent tooth little if any larger than adjacent teeth 55

53 (*52*) Third and fourth teeth of anterolateral border definitely pointed forward with outer borders curved 54

53 (*52*) Third and fourth teeth of anterolateral border triangular and pointing outward or slightly forward, outer borders not conspicuously curved ..... *Hexapanopeus angustifrons*

Figure 96.—*Hexapanopeus angustifrons*, carapace and eyes.

54 (*53*) Tooth at base of major dactyl large and conspicuous; carapace definitely arched above ..... *Panopeus herbstii*

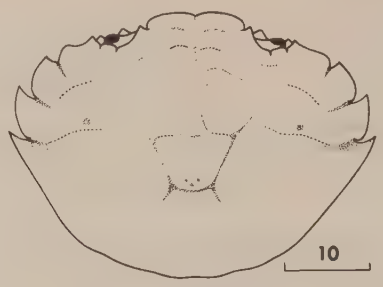


Figure 97.—*Panopeus herbstii,* carapace and eyes.

54 (*53*) Tooth at base of major dactyl present but often not large and conspicuous; posterior two-thirds of carapace flattened above ..... *Eurypanopeus depressus*

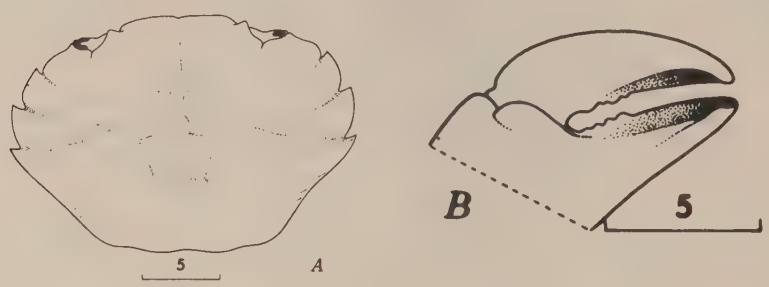


Figure 98.—*Eurypanopeus depressus;* A, carapace and eyes; B, fingers of minor chela, inner view.

55 (*52*) Ischium of third maxillipeds with prominent red spot on appressed surface; fingers of minor chela hollowed or spoon shaped on opposed surfaces distally ... *Eurypanopeus depressus*

55 (*52*) Ischium of third maxillipeds usually lacking red spot on appressed surface, very small in few individuals possessing it; fingers of minor chela hooked but not spoon shaped on opposed surfaces distally ..... *Neopanope sayi*

Figure 99.—*Neopanope sayi;* A, carapace and eyes; B, fingers of minor chela, inner view.

56 (42) Dactyls of walking legs simple, acute 57

56 (42) Dactyls of first, second, and third walking legs bifurcate ..... *Dissodactylus mellitae*

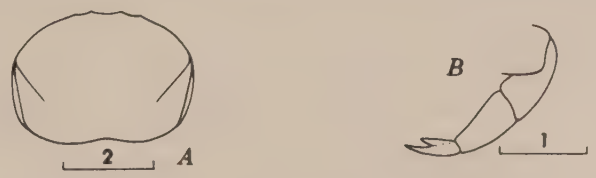


Figure 100.—*Dissodactylus mellitae;* A, carapace; B, walking leg with bifurcate dactyl.

57 (56) Third walking legs little if any longer than other legs ..... *Pinnotheres* A

A (57) Small, hard-stage males and females ..... B

A (57) Older, larger, posthard (soft) females (and male *maculatus*) C

B (A) Carapace with a striking pattern of light spots on dark background of pubescence ..... *P. maculatus*

B (A) No striking color pattern ..... *P. ostreum*

Figure 101.—Carapace and eyes of male *Pinnotheres;* A, *maculatus;* B, *ostreum.*

C (B) Carapace nearly naked ..... *P. ostreum*

C (B) Carapace covered with short deciduous pubescence ..... *P. maculatus*

Figure 102.—Carapace of mature female *Pinnotheres;* A, *maculatus;* B, *ostreum,* including portion of greatly expanded abdomen.

57 (56) Third walking leg longer and stronger than others, often considerably so ..... *Pinnixa* A

A (57) Chela with immovable finger nearly same length as dactyl, straight or nearly so, not bent downward ..... *P. cylindrica*

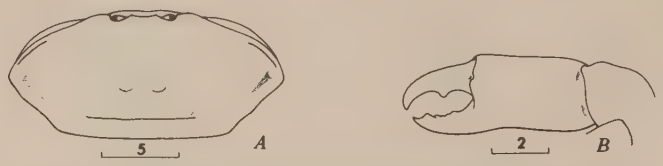


Figure 103.—*Pinnixa cylindrica;* A, carapace and eyes; B, chela.

A (56) Chela with immovable finger shorter than dactyl, bent downward, or reduced to stub ..... B

B (A) Propodus of third walking leg less than twice as long as wide ..... *P. chaetopterana*

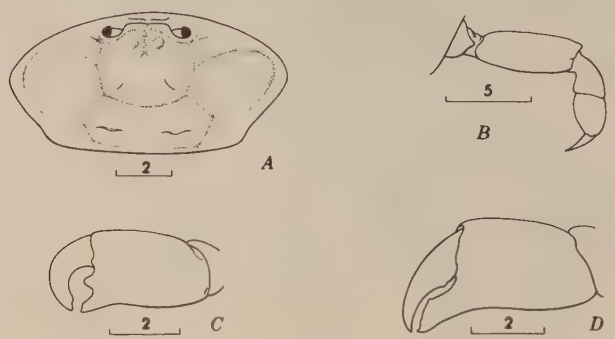


Figure 104.—*Pinnixa chaetopterana;* A, carapace and eyes; B, third leg; C, chela of male; D, chela of female.

B (A) Propodus of third walking leg slender, twice or more than twice as long as wide ..... *P. sayana*

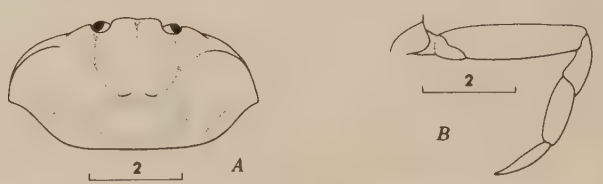


Figure 105.—*Pinnixa sayana;* A, carapace and eyes; B, third leg.

58 *(41)* Eyestalks shorter than width of front; gap of varying size between third maxillipeds ..... Family Grapsidae 59

58 *(41)* Eyestalks longer than width of front; third maxillipeds nearly or quite closing over buccal area ..... Family Ocypodidae 60

59 *(58)* Carapace broader than long and almost rectangular in outline; third maxillipeds with oblique hairy ridge crossing ischium and merus ..... *Sesarma reticulatum*

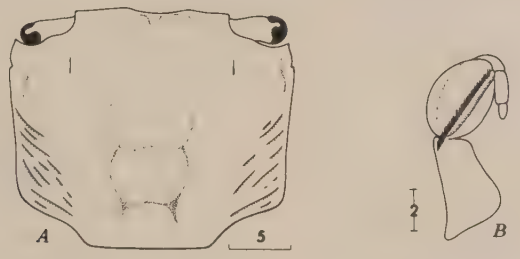


Figure 106.—*Sesarma reticulatum;* A, carapace and eyes; B, third maxilliped.

59 *(58)* Carapace about as long as broad, somewhat narrowed and rounded in adults; third maxillipeds without hairy oblique ridge crossing ischium and merus; legs strongly fringed with hairs. (Occurs on *Sargassum* and flotsam.) ..... *Planes minutus*

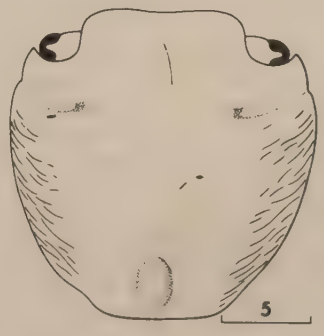


Figure 107 —*Planes minutus;* carapace and eyes.

60 (*58*) Stout eyestalks with conspicuous, enlarged, club-shaped cornea; chelipeds of both sexes well developed and somewhat unequal ..... *Ocypode* ***quadrata***

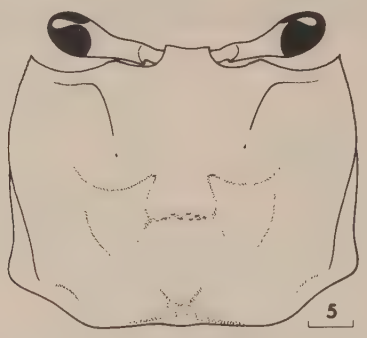


Figure 108.—*Ocypode quadrata;* carapace and eyes.

60 (*58*) Slender eyestalks with cornea not conspicuously enlarged and club-shaped; chelipeds of male very unequal, of female equal and quite small ..... *Uca* A

A (*60*) Last legs with upper surface of merus straight; large chela of male without oblique tuberculate ridge on inner surface of palm extending upward from lower margin ..... *U. pugilator*

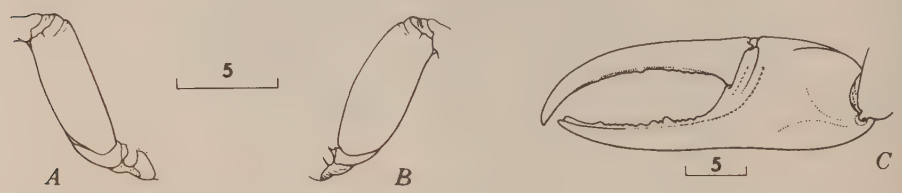


Figure 109.—*Uca pugilator;* A, merus of last leg; C, chela of male, inner view. *U. pugnax,* B, merus of last leg.

A (*60*) Last legs with upper surface of merus curved; large chela of male with oblique tuberculate ridge on inner surface of palm extending upward from lower margin .....B

B (*A*) A transverse shelf or depression on carapace behind orbit; leg joints red on large cheliped ..... *U. minax*

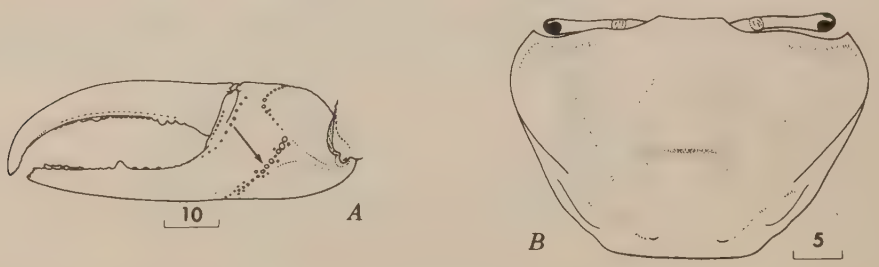


Figure 110.—*Uca minax;* A, chela of male, inner view; B, carapace and eyes.

B *(A)* Without transverse shelf or depression on carapace behind orbit; leg joints not red on large cheliped ..... *U. pugnax*

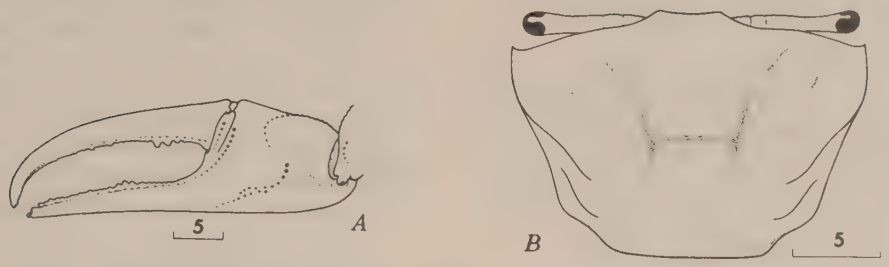


Figure 111.—*Uca pugnax;* A, chela of male, inner view; B, carapace and eyes.

ANNOTATED SYSTEMATIC LIST

This check list is arranged in a systematic hierarchy accommodating categories from order to species, with genera arranged alphabetically under family and species under genus. Notes on distribution, habitat, and general occurrence are given. References to important works are cited. Depths are rounded to 5-m intervals, except those below 5 m.

CLASS CRUSTACEA
ORDER DECAPODA
SUBORDER NATANTIA

SECTION PENAEIDEA

FAMILY SERGESTIDAE

Lucifer faxoni Borradaile, 1915. Nova Scotia to Rio de Janeiro, Brazil; primarily in coastal waters. Surface to 90 m (Bowman and McCain, 1967).

FAMILY PENAEIDAE

Parapenaeus longirostris (Lucas, 1849). Martha's Vineyard, Mass., to Gulf of Mexico off Florida, Louisiana, and peninsula de Yucatán; Gulf of Paria off Venezuela; coast of Portugal to Morocco; Mediterranean Sea from Spain to Asia Minor. 25-350 m in western Atlantic; to 460 m in Mediterranean. Rare in north (Williams, 1965).

Penaeus (Melicertus) aztecus aztecus Ives, 1891. Brown shrimp. West Falmouth Harbor and Martha's Vineyard, Mass., to off Sanibel Island, Fla.; Appalachicola Bay around Gulf of Mexico to northwestern Estado de Yucatán. Fished commercially. Shallows to 110 m, occasionally 165 m. Summer and fall in north, rare (Pérez Farfante, 1969).

Penaeus (Litopenaeus) setiferus (Linnaeus, 1767). White shrimp. Fire Island, N.Y., to St. Lucie Inlet, Fla.; mouth Ochlockonee River [Franklin County], Fla., to northwestern Estado de Yucatán. Fished commercially. Shallows to 35 m, occasionally to 85 m. Summer in north, rare (Pérez Farfante, 1969).

SECTION CARIDEA

FAMILY PASIPHAEIDAE

Pasiphaea multidentata Esmark, 1866. Northern Atlantic; western Norway to Mediterranean Sea; Iceland; Greenland; Cape Breton Island to Cape Cod. 10 (rarely) to 2,000 m (Sivertsen and Holthuis, 1956).

FAMILY PALAEMONIDAE

Leander tenuicornis (Say, 1818). Tropical and subtropical waters of world except west coast of Americas; Newfoundland Banks, Bay of Fundy, and New England to Falkland Islands in western Atlantic. Floating *Sargassum,* pilings, and submerged vegetation (Chace, 1972).

Palaemonetes (Palaemonetes) intermedius Holthuis, 1949. Long Island, N.Y., to Port Aransas, Tex. (and literature records from Vineyard Sound, Mass.). Estuaries, especially in submerged vegetation (Holthuis, 1952).

Palaemonetes (Palaemonetes) pugio Holthuis, 1949. Newcastle, Me., and Yarmouth, Nova Scotia, to Port Aransas, Tex. (literature re-

cords to Corpus Christi, Tex.). Estuaries, especially in submerged vegetation (Holthuis, 1952). Nova Scotia and other Maine records from R. E. Knowlton and E. C. Bousfield (pers. comm.).

Palaemonetes (Palaemonetes) vulgaris (Say, 1818). Southwest coast Gulf of St. Lawrence to Cameron County, Tex. (literature records somewhat farther south). Estuaries, to 15 m, especially in submerged vegetation (Holthuis, 1952). Canadian distribution from R. E. Knowlton (pers. comm.).

FAMILY HIPPOLYTIDAE

Eualus fabricii Krøyer, 1841. North Greenland to Cape Cod; Arctic Alaska to Cook Inlet; Siberian seacoast; Japanese Sea. 4-200 m (Holthuis, 1947).

Eualus gaimardii (H. Milne Edwards, 1837). Circumarctic southward to Cape Cod, North Sea (Kiel and Yarmouth), White Sea, Sitka (Alaska), Siberia. 10-900 m (Holthuis, 1947).

Eualus pusiolus (Krøyer, 1841). Gulf of St. Lawrence to off Cape Henry, Va.; Bering Island, Alaska Peninsula, and Aleutian Islands; San Juan Islands, Wash.; Iceland; Murman coast to Channel Islands; northeastern Spain. <1-500 m (Holthuis, 1947).

Hippolyte pleuracanthus (Stimpson, 1871). Connecticut to North Carolina. Beds of submerged vegetation (Chace, 1972).

Hippolyte zostericola (Smith, 1873). Bermuda; Massachusetts; North Carolina to Yucatan; West Indies to Trinidad and Curaçao. Beds of submerged vegetation (Chace, 1972).

Latreutes fucorum (Fabricius, 1798). Western North Atlantic between lat. 10° and 50°N; Azores and Cape Verde Islands. Pelagic and sublittoral, in floating masses of *Sargassum* and submerged grasses (Chace, 1972).

Lebbeus groenlandicus (Fabricius, 1775). Greenland southward to Rhode Island; arctic Canada and Alaska; Bering Sea to Puget Sound; Sea of Okhotsk. 2-210 m (Holthuis, 1947).

Lebbeus polaris (Sabine, 1821). Circumarctic southward to off Chesapeake Bay, Bering Sea, Sea of Okhotsk, Skagerrak, and Hebrides. <1-930 m (Holthuis, 1947).

Lebbeus zebra (Leim, 1921). Port Burwell, Ungava; New Brunswick, Nova Scotia (Bay of Fundy. 10-30 m (Holthuis, 1947).

Spirontocaris liljeborgii (Danielssen, 1859). Greenland; Nova Scotia to off Delaware Bay; arctic Alaska; Iceland; Spitzbergen and Murman coast to south coast of England. 20-1,200 m (Holthuis, 1947).

Spirontocaris phippsii (Krøyer, 1841). Circumarctic, southward to near Martha's Vineyard, northern Norway, Shumagin Islands (Alaska), and Plover Bay (Siberia). 10-270 m (Holthuis, 1947).

Spirontocaris spinus (Sowerby, 1805). Circumarctic, southward to near Martha's Vineyard, North Sea, Bering Strait to Alaskan Peninsula, Hood Canal, near Union City (Wash.), Siberian coast. 10-465 m (Holthuis, 1947).

FAMILY PANDALIDAE

Dichelopandalus leptoceras (Smith, 1881). Newfoundland Banks to North Carolina; Shumagin Bank, Alaska. 15-790 m (Rathbun, 1929).

Pandalus borealis Krøyer, 1838. Pink shrimp. Circumarctic, southward to off Martha's Vineyard (Mass.), Bering Sea, and stragglers to San Diego (Calif.), northern Europe including Britain, northern Japan. Fished commercially. 45-905 m (Rathbun, 1929; Wigley, 1960).

Pandalus montagui Leach, 1813 or 1814. Striped pink shrimp. Greenland to Rhode Island; Iceland; northern Europe including British Isles. Fished commercially. 5-790 m (Rathbun, 1929; Wigley, 1960).

Pandalus propinquus G. O. Sars, 1869. Davis Strait; Newfoundland Banks to Delaware; Iceland; northwestern Europe. Fished commercially. 60-2,000 m (Rathbun, 1929; Wigley, 1960).

FAMILY CRANGONIDAE

Crangon septemspinosa Say, 1818. Sand shrimp. Baffin Bay to eastern Florida; arctic Alaska to Shumagin Islands, Sea of Okhotsk; Hokkaido, Japan. Sandy bottom, low tide mark to 90 m, rarely 450 m (Price, 1962).

Pontophilus brevirostris Smith, 1881. Gulf of Maine to Gulf of Mexico off Cuba. 25-350 m.

Pontophilus norvegicus (M. Sars, 1861). Greenland to Long Island; Iceland; Spitzbergen; northwestern Europe. 50-945 m (Rathbun, 1929).

Sabinea sarsii Smith, 1879. Davis Strait to Gulf of Maine; Iceland; northern Europe. 75-710 m (Rathbun, 1929).

Sabinea septemcarinata (Sabine, 1824). Mouth St. Lawrence River to Massachusetts Bay; Arctic Ocean to Pt. Barrow (Alaska), White Sea, and northern Europe. 10-240 m (Rathbun, 1929).

Sclerocrangon boreas (Phipps, 1774). Arctic Ocean southward to Cape Cod, Aleutian Islands, and Alexander Archipelago (Alaska), northeastern Siberia. <1-260 m (Rathbun, 1929).

SUBORDER REPTANTIA

SECTION MACRURA

SUPERFAMILY ASTACIDEA

FAMILY NEPHROPSIDAE

Homarus americanus H. Milne Edwards, 1837. American lobster. Labrador to North Carolina. Fished commercially. Near low tide mark to about 700 m (Herrick, 1895; Templeman and Tibbo, 1945; R. L. Wigley, pers. comm.).

SUPERFAMILY THALASSINIDEA

FAMILY LAOMEDIIDAE

Naushonia crangonoides Kingsley, 1897. Massachusetts; Bass River, Vineyard Sound, and Elizabeth Islands. Shallow channels near shore.

FAMILY CALLIANASSIDAE

Callianassa (Callichirus) atlantica Rathbun, 1926. Bass River, Nova Scotia to Sapelo Island, Ga.; Franklin County, Fla. Muddy shores and shallow littoral to 40 m (Schmitt, 1935).

FAMILY UPOGEBIIDAE

Upogebia affinis (Say, 1818). Cape Cod Bay (Wellfleet, Mass.) to Rockport, Tex.; through West Indies to Maceió, Alagoas, Brazil. Burrows in estuarine littoral; intertidal to 25 m (Williams, 1965).

FAMILY AXIIDAE

Axius serratus Stimpson, 1852. Bay of Fundy to Long Island Sound. 20-100 m (Rathbun, 1929).

Calocaris templemani Squires, 1965. (Greenland ?); Hermitage Bay, Newfoundland; Gulf of Maine. 200-260 m [?].

SECTION ANOMURA

SUPERFAMILY GALATHEIDEA

FAMILY GALATHEIDAE

Munida iris A. Milne Edwards, 1880. Southwestern Georges Bank to off Isla de Cozumel, Quintana Roo; off mouth of Amazon River. 70-730 m (Chace, 1942).

Munida valida Smith, 1883. Southern Georges Bank to Golfo de Morrosquillo, Colombia, and Curaçao. 90-825 m (Chace, 1942).

FAMILY PORCELLANIDAE

Polyonyx gibbesi Haig, 1956. Woods Hole, Mass., to Alligator Harbor, Fla.; Puerto Rico; Panama; Brazil (?). Commensal of *Chaetopterus variopedatus*, intertidal to 15 m (Williams, 1965).

Porcellana sigesbiana A. Milne Edwards, 1880. Off Martha's Vineyard, Mass., to Gulf of Mexico off peninsula de Yucatán; West Indies to Virgin Islands. 50-390 m (Williams, 1965).

SUPERFAMILY PAGUROIDEA

FAMILY PAGURIDAE

Pagurus acadianus Benedict, 1901. Grand Banks of Newfoundland and Gulf of St. Lawrence to mouth of Chesapeake Bay. Low water mark to 485 m (Rathbun, 1929).

Pagurus annulipes Stimpson, 1860. Vineyard Sound, Mass., to Beaufort, N.C., possibly to northeastern Florida; Cedar Key, Fla., to Texas. Variety of bottoms, but predominantly on sand, nearshore and estuaries to 40 m (Williams, 1965; Rouse, 1970).

Pagurus arcuatus Squires, 1964. Greenland to New Jersey. Low water mark to 270 m.

Pagurus longicarpus Say, 1817. Minas Basin, Nova Scotia to northeastern Florida; Sanibel Island, Fla., to Texas. Shallow littoral of ocean and estuaries on variety of bottoms to 50 m (Williams, 1965).

Pagurus politus (Smith, 1882). Georges Bank to off Dry Tortugas. 20(?) 60-1,170 m.

Pagurus pollicaris Say, 1817. Vineyard Sound, Mass., to northeastern Florida; Key West, Fla., to Texas. Ocean and mouths of estuaries, low tide mark to 45 m (Williams, 1965).

Pagurus pubescens Krøyer, 1838. West Greenland, Foxe Basin, and Hudson Bay to New Jersey; Spitzbergen, Novaya Zemlya, and Barents Sea to Faeroes, Hebrides, England (except south coast), and southwestern Ireland. 6-600 m (Rathbun, 1929; Squires, 1964).

FAMILY LITHODIDAE

Lithodes maja (Linnaeus, 1758). Greenland

to Sandy Hook, N.J.; northwestern Europe to Belgium and Isle of Man. 65-535 m (Rathbun, 1929).

SUPERFAMILY HIPPIDEA

FAMILY HIPPIDAE

Emerita talpoida (Say, 1817). Mole crab, sand bug. Barnstable County, Mass., to east coast of Florida; west coast of Florida to Grand Isle, La.; Progreso, Yucatán. Wave washed sandy beaches and below surf line to 3.5 m (Williams, 1965).

SECTION BRACHYURA

SUBSECTION DROMIACEA

FAMILY HOMOLIDAE

Homola barbata (Fabricius, 1793). Off southeastern Massachusetts to Caribbean Sea; eastern Atlantic from Portugal and Azores to Madeira Islands; Mediterranean Sea; South Africa. 55-685 m (Williams, 1965).

SUBSECTION OXYSTOMATA

FAMILY DORIPPIDAE

Ethusa microphthalma Smith, 1881. Off Martha's Vineyard, Mass., to west Florida, and Cuba. 110-575 m (Rathbun, 1937).

FAMILY LEUCOSIIDAE

Persephona aquilonaris Rathbun, 1937. New Jersey to Estado de Campeche, Mexico. 37-55 m (Guinot-Dumortier, 1959).

FAMILY CALAPPIDAE

Acanthocarpus alexandri Stimpson, 1871. Georges Bank to west coast of Florida; Puerto Rico to Grenadines; Brazil. 70-380 m (Williams, 1965).

SUBSECTION BRACHYGNATHA

SUPERFAMILY OXYRHYNCHA

FAMILY MAJIDAE

SUBFAMILY OREGONIINAE

Hyas araneus (Linnaeus, 1758). West Greenland; Labrador to Rhode Island; between Greenland and Iceland, through British Isles and northwest France to Spitzbergen and west Kara Sea. <1-360 m, usually <50 m, hard and soft bottom (Christiansen, 1969).

Hyas coarctatus Leach, 1815. Typical subspecies from Labrador to North Carolina; between Greenland and Iceland, through British Isles, southwestern and northwestern France, to Spitzbergen and eastern Barents Sea. <1-500 m, usually <50 m, hard and soft bottom (Christiansen, 1969).

SUBFAMILY INACHINAE

Collodes robustus Smith, 1881. South of Nantucket, Mass., to off Cape Hatteras, N.C. 90-685 m (Rathbun, 1925).

Euprognatha rastellifera Stimpson, 1871. Off Georges Bank to southern Gulf of Mexico; West Indies to Grenada and Barbados. 25-710 m. Rathbun (1925) recognized a blunt spined northern subspecies, *marthae*, ranging from New England to the Florida Keys (Williams, 1965).

SUBFAMILY PISINAE

Libinia dubia H. Milne Edwards, 1834. Cape Cod, Mass., to southern Texas; Bahamas and Cuba. Ocean and high salinity estuaries on a variety of substrates from low tide mark to 45 m (Williams, 1965).

Libinia emarginata Leach, 1815. Windsor, Nova Scotia, to western Gulf of Mexico. Ocean and high salinity estuaries on a variety of substrates from near low tide mark to 50 m, rarely to 125 m (Williams, 1965).

Pelia mutica (Gibbes, 1850). Buzzards Bay and Vineyard Sound, Mass., to west coast of Florida; Cuba to St. Thomas. Estuarine and oceanic sublittoral on coarse substrate and encrusted pilings, low water mark to 50 m (Williams, 1965).

FAMILY PARTHENOPIDAE

Heterocrypta granulata (Gibbes, 1850). Nantucket Sound, Mass., to Georgia; Florida Straits to Sabine, Tex.; through West Indies to Trinidad. Shingle and shelly substrate of estuarine and oceanic littoral, 3.5-135 m (Williams, 1965).

Parthenope (Platylambrus) pourtalesii (Stimpson, 1871). Off Martha's Vineyard, Mass., through West Indies to Grenada. Predominantly on sand or sandy mud, 20-250 m (Williams, 1965).

SUPERFAMILY BRACHYRHYNCHA

FAMILY PORTUNIDAE

Arenaeus cribrarius (Lamarck, 1818). Vine-

yard Sound, Mass., to Estado de Santa Catarina, Brazil. Usually in or near waves and shifting sand along ocean beaches. Water line to 70 m (Williams, 1965).

Bathynectes superbus (Costa, 1838). Martha's Vineyard, Mass., to Florida Straits; off Norway, Shetland and Faeroe Islands, to Angola; Mediterranean Sea. 180-1,455 m (Christiansen, 1969).

Callinectes sapidus Rathbun, 1896. Blue crab. Nova Scotia to Mar del Plata, Argentina; Bermuda. Introduced in Mediterranean and Baltic seas. Fished commercially. Variety of substrates in rivers, estuaries and shallow oceanic littoral to 40 m (Williams, 1965; Chace and Hobbs, 1969).

Callinectes similis Williams, 1966. Cape May, N.J., to off Soto La Marina, Mexico (140 miles south of the mouth of Rio Grande River). Usually oceanic; water's edge to 35-40 m, occasionally to 80 m, once at surface over a 1,685-m depth.

Carcinus maenas (Linnaeus, 1758). Nova Scotia to Virginia; Iceland; Faeroe Islands; Kvaenangen, Norway, southward including parts of southern Baltic Sea, and British Isles through Portugal; Mauritania; Australia. Probably introduced in United States and Australia, and temporarily elsewhere. On variety of substrates in estuarine and oceanic shallow littoral. Intertidal to occasionally 200 m (Christiansen, 1969).

Ovalipes ocellatus (Herbst, 1799). Prince Edward Island, Canada to Florida; Texas coast (?). Variety of substrates but especially on sand. Surface to 33 m (Williams, 1965).

Portunus sayi (Gibbes, 1850). Nova Scotia through Gulf of Mexico to Brazil; Bermuda and mid-Atlantic Ocean; Kerguelen Island. Usually pelagic among floating *Sargassum* (Williams, 1965).

Portunus gibbesii (Stimpson, 1859). Southern Massachusetts to Texas; Venezuela; Surinam. Surface to 90 m, seldom deeper (Williams, 1965).

Portunus spinimanus Latreille, 1819. New Jersey through Gulf of Mexico and West Indies to southern Brazil; Bermuda. On beach under *Sargassum* to 90 m (Williams, 1965).

FAMILY CANCRIDAE

Cancer borealis Stimpson, 1859. Nova Scotia to south of Tortugas, Fla.; Bermuda. On various substrates, intertidal to 800 m; shallower in north than in south, some seasonal movement (Williams, 1965; Jeffries, 1966).

Cancer irroratus Say, 1817. Labrador to Florida. On various but usually coarse substrates, low water mark to 575 m; shallower in north than in south, some seasonal movement (Williams, 1965; Jeffries, 1966).

FAMILY XANTHIDAE

Eurypanopeus depressus (Smith, 1869). Massachusetts Bay and Provincetown, Mass., through Florida to Texas; Bermuda; West Indies. Mainly oyster bars in estuaries; oceanic littoral. Low water mark to 50 m (Williams, 1965).

Hexapanopeus angustifrons (Benedict and Rathbun, 1891). Vineyard Sound, Mass., to Port Aransas, Tex.; Bahamas; Jamaica. Shelly substrates in high salinity estuaries, but mainly oceanic. Nearshore to 140 m (Williams, 1965).

Neopanope sayi (Smith, 1869). Miramichi Bay, Prince Edward Island, and Cape Breton Island, New Brunswick, to Crooked Island Sound, Fla. Introduced, Swansea, Wales. Various substrates, but mainly mud in estuaries. Low tide mark to 25 m (Williams, 1965; Abele, 1972).

Panopeus herbstii H. Milne Edwards, 1834. Boston (?), Woods Hole, Mass., to Uruguay; Bermuda. Variety of substrates, estuarine and oceanic. Intertidal to 20 m (Williams, 1965; Chace and Hobbs, 1969).

Rhithropanopeus harrisii (Gould, 1841). Original range, estuaries from New Brunswick, Canada, to Veracruz, Mexico; northeastern Brazil. Introduced, Coos Bay, Oreg., and San Francisco Bay, Calif.; northwest Europe and Black Sea. Water's edge to 35 m (Williams, 1965; Christiansen, 1969).

FAMILY GERYONIDAE

Geryon quinquidens Smith, 1879. Deep sea red crab. Off Nova Scotia to Cabo Frio, Brazil. 40-2,160 m (Rathbun, 1937).

FAMILY PINNOTHERIDAE

Dissodactylus mellitae (Rathbun, 1900). Vineyard Sound, Mass., to Charleston, S.C.; west Florida. Commensal with sand dollars. Shallow water to 20 m (Williams, 1965).

Pinnixa chaetopterana Stimpson, 1860. Wellfleet, Mass., to South Carolina; Punta Rassa, Fla., to Galveston, Tex.; Rio de Janeiro, and Villa Bella, São Sebastião, Brazil. Commensal with *Chaetopterus variopedatus*, *Amphitrite ornata*, and *Callianassa* species. Intertidal to 15 m (Williams, 1965).

Pinnixa cylindrica (Say, 1818). North Falmouth, Mass., to Alligator Harbor, Fla. Commensal with *Arenicola cristata*, and probably other large annelids. Shallow water to 35 m (Williams, 1965).

Pinnixa sayana Stimpson, 1860. Vineyard Sound, Mass., to Beaufort, N.C.; Sarasota Bay, Fla., to Grand Isle, La. Reported as commensal with *Arenicola cristata*, but also free in water. Shore to 50 m (Williams, 1965).

Pinnotheres maculatus Say, 1818. Mussel crab. Off Martha's Vineyard, Mass., to Mar del Plata, Argentina. Parasitic in bivalve mollusks. *Argopecten irradians*, *A. gibbus*, *Atrina serratus*, *Modiolus modiolus*, *M. americanus*, *Mya arenaria*, *Mytilus edulis*, and with *Chaetopterus variopedatus*, *Molgula robusta*, *Bostrichobranchus pilularis*, and on *Asterias vulgaris*, as well as free-swimming stages. Surface to 45 m (Williams, 1965).

Pinnotheres ostreum Say, 1817. Oyster crab. Salem, Mass., to Estado de Santa Catarina, Brazil. Parasitic in bivalve mollusks, *Argopecten* species, *Anomia simplex*, *Crassostrea virginica*, *Mytilus edulis*, and with *Chaetopterus variopedatus* as well as free-swimming stages in estuaries. Depth limits not recorded (Williams, 1965).

FAMILY GRAPSIDAE

Planes minutus (Linnaeus, 1758). Gulf weed crab, turtle crab, Columbus crab. Atlantic Ocean south of Newfoundland, west of lat 50°W, and exclusive of Gulf of Mexico; occasionally on coast of Netherlands, southwest England, Portugal, and Mediterranean Sea. Common in *Sargassum* (Chace, 1951; Christiansen, 1969).

Sesarma reticulatum (Say, 1817). Woods Hole, Mass., to Calhoun County, Tex. Burrows in muddy salt marshes (Williams, 1965).

FAMILY OCYPODIDAE

Ocypode quadrata (Fabricius, 1787). Ghost crab. Woods Hole, Mass., to Estado de Santa Catarina, Brazil. Semiterrestrial; burrows along ocean beaches and occasionally on harbor beaches (Williams, 1965; Chace and Hobbs, 1969).

Uca minax (Le Conte, 1855). Red jointed fiddler. Buzzards Bay (Wareham) Mass., to Matagorda Bay, Tex.; Colombia; Dominican Republic. Usually on muddy or muddy sand substrates of low salinity marshes; a burrower (Williams, 1965).

Uca pugilator (Bosc, 1801 or 1802). Sand fiddler. Boston Harbor, Mass., to Corpus Christi, Tex. Sandy and muddy beaches bordering marshes and tidal creeks; a burrower (Williams, 1965).

Uca pugnax (Smith, 1870). Mud fiddler. Cape Cod, Mass., to near Daytona Beach, Fla. Primarily on intertidal mud flats among *Spartina;* a burrower (Williams, 1965: Salmon and Atsaides, 1968).

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INDEX TO SCIENTIFIC NAMES

Acanthocarpus alexandri 24, 42
Anomura 1, 17, 41
Arenaeus cribrarius 30, 42
Astacidea 15, 41
Axiidae 17, 41
Axius serratus 17, 41
Bathynectes superbus 29, 43
Brachygnatha 24, 42
Brachyrhyncha 25, 42
Brachyura 1, 17, 42
Calappidae 24, 42
Callianassa atlantica 16, 41
Callianassidae 16, 41
Callinectes
sapidus 2, 30, 43
similis 30, 43
Calocaris templemani 17, 41
Cancer
borealis 32, 43
irroratus 32, 43
Cancridae 32, 43
Carcinus maenas 29, 43
Caridea 5, 39
Collodes robustus 26, 42
Crangonidae 6, 40
Crangon septemspinosa 14, 40
Crustacea 1, 39
Decapoda 1, 39
Dichelopandalus leptoceras 12, 40
Dissodactylus mellitae 35, 44
Dorippidae 23, 42
Dromiacea 24, 42
Emerita talpoida 18, 42
Ethusa microphthalma 23, 42
Eualus
fabricii 9, 40
gaimardii 9, 40
pusiolus 9, 40
Euprognatha rastellifera 26, 42
Eurypanopeus depressus 34, 43
Galatheidae 22, 41
Galatheidea 18, 41
Geryonidae 32, 44
Geryon quinquedens 32, 44
Grapsidae 37, 44
Heterocrypta granulata 28, 42
Hexapanopeus angustifrons 33, 43
Hippidae 18, 42
Hippidea 18, 42
Hippolyte
pleuracanthus 8, 40
zostericola 9, 40
Hippolytidae 8, 40
Homarus americanus 2, 15, 41
Homola barbata 24, 42
Homolidae 24, 42
Hyas
araneus 25, 42
coarctatus 25, 42
Inachinae 26, 42
Laomediidae 16, 41
Latreutes fucorum 8, 40
Leander tenuicornis 6, 39
Lebbeus
groenlandicus 11, 40
polaris 11, 40
zebra 11, 40
Leucosiidae 24, 42
Libinia
dubia 27, 42
emarginata 27, 42
Lithodes maja 21, 41
Lithodidae 21, 41
Lucifer faxoni 5, 39
Macrura 1, 15, 41
Majidae 25, 42
Munida
iris 22, 41
valida 22, 41
Natantia 1, 4, 39
Naushonia crangonoides 16, 41
Neopanope sayi 34, 43
Nephropsidae 15, 41
Ocypode quadrata 38, 44
Ocypodidae 37, 44
Oregoniinae 25, 42
Ovalipes ocellatus 29, 43
Oxyrhyncha 25, 42
Oxystomata 23, 42
Paguridae 18, 41
Paguroidea 18, 41
Pagurus
acadianus 19, 41
annulipes 18, 41
arcuatus 20, 41
longicarpus 19, 41
politus 21, 41
pollicaris 19, 41
pubescens 20, 41

Palaemonetes
intermedius 7, 39
pugio 7, 39
vulgaris 7, 40
Palaemonidae 6, 39
Pandalidae 8, 40
Pandalus
borealis 2, 12, 40
montagui 2, 13, 40
propinquus 2, 12, 40
Panopeus herbstii 34, 43
Parapenaeus longirostris 5, 39
Parthenope pourtalesii 28, 42
Parthenopidae 25, 42
Pasiphaea multidentata 6, 39
Pasiphaeidae 6, 39
Pelia mutica 27, 42
Penaeidae 5, 39
Penaeidea 4, 39
Penaeus
aztecus aztecus 2, 5, 39
setiferus 2, 5, 39
Persephona aquilonaris 24, 42
Pinnixa
chaetopterana 36, 44
cylindrica 36, 44
sayana 36, 44
Pinnotheres
maculatus 35, 44
ostreum 35, 44
Pinnotheridae 28, 44
Pisinae 26, 42
Planes minutus 37, 44
Polyonyx gibbesi 22, 41
Pontophilus
brevirostris 14, 40
norvegicus 14, 40
Porcellana sigesbiana 23, 41
Porcellanidae 22, 41
Portunidae 28, 42
Portunus
gibbesii 31, 43
sayi 31, 43
spinimanus 31, 43
Reptantia 1, 4, 41
Rhithropanopeus harrisii 33, 43
Sabinea
sarsii 13, 40
septemcarinata 13, 41
Sclerocrangon boreas 15, 41
Sergestidae 5, 39
Sesarma reticulatum 37, 44
Spirontocaris
liljeborgii 10, 40
phippsii 10, 40
spinus 10, 40
Thalassinidea 15, 41
Tozeuma carolinense 9
Uca
minax 38, 44
pugilator 38, 44
pugnax 39, 44
Upogebia affinis 16, 41
Upogebiidae 16, 41
Xanthidae 32, 43

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The Board established the format for the "Marine Flora and Fauna of the Northeastern United States," invites systematists to collaborate in the preparation of manuals, reviews manuscripts, and advises the Scientific Editor of the National Marine Fisheries Service.

Collections and records in the National Museum of Natural History, Washington, D.C., those of Roland L. Wigley at the National Marine Fisheries Service, Northeast Atlantic Fisheries Center in Woods Hole, as well as those in the Gray Museum, Marine Biological Laboratory, Woods Hole, provided reference materials for this paper. Bruce B. Collette, Isabel Pérez Farfante, Marie B. Abbott, William D. Burbanck, and Roland L. Wigley critically read the manuscript. All illustrations were drawn by Maria M. Diéguez.

COORDINATOR'S COMMENTS

Publication of the "Marine Flora and Fauna of the Northeastern United States" is most timely in view of the growing universal emphasis on environmental work and the urgent need for more precise and complete identification of coastal organisms than has been available. It is mandatory, wherever possible, that organisms be identified accurately to species. Accurate scientific names unlock the great quantities of biological information stored in libraries, obviate duplication of research already done, and make possible prediction of attributes of organisms that have been inadequately studied.

Austin B. Williams commenced his study of the systematics of the Crustacea in 1946 working on crayfishes in the Ozarks and eastern Great Plains. In 1951 he joined the staff of the University of North Carolina Institute of Marine Sciences, Morehead City, to carry on ecological and systematic studies on decapod crustaceans of the estuaries and continental shelf of the southeastern United States. This work concentrated on ecology of penaeid shrimps, an illustrated handbook on decapod crustaceans of the Carolinas (1965), and studies on estuarine meroplankton. Williams moved to his present position in 1971 where his systematic studies continue. This key represents an extension of his work on decapods of the Carolinian Province.

Manuals are available for purchase from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The manuals so far published in the series and their cost are listed below.

COOK, DAVID G., and RALPH O. BRINKHURST. Marine flora and fauna of the Northeastern United States. Annelida: Oligochaeta.
BORROR, ARTHUR C. Marine flora and fauna of the Northeastern United States. Protozoa: Ciliophora.
MOUL, EDWIN T. Marine flora and fauna of the Northeastern United States. Higher plants of the marine fringe.
McCLOSKEY, LAWRENCE R. Marine flora and fauna of the Northeastern United States. Pycnogonida.
MANNING, RAYMOND B. Marine flora and fauna of the Northeastern United States. Crustacea: Stomatopoda.
WILLIAMS, AUSTIN B. Marine flora and fauna of the Northeastern United States. Crustacea: Decapoda.

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370. Collecting and processing data on fish eggs and larvae in the California Current region. By David Kramer, Mary J. Kalin, Elizabeth G. Stevens, James R. Thrailkill, and James R. Zweifel. November 1972, iv + 38 pp., 38 figs., 2 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

371. Ocean fishery management: Discussions and research. By Adam A. Sokoloski (editor). (17 papers, 24 authors.) April 1973, vi + 173 pp., 38 figs., 32 tables, 7 appendix tables.

372. Fishery publications, calendar year 1971: Lists and indexes. By Thomas A. Manar. October 1972, iv + 24 pp., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

374. Marine flora and fauna of the northeastern United States. Annelida: Oligochaeta. By David G. Cook and Ralph O. Brinkhurst. May 1973, iii + 23 pp., 82 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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376. Bottom-water temperatures on the continental shelf, Nova Scotia to New Jersey. By John B. Colton, Jr. and Ruth R. Stoddard. June 1973, iii + 55 pp., 15 figs., 12 appendix tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

377. Fishery publications, calendar year 1970: Lists and indexes. By Mary Ellen Engett and Lee C. Thorson. December 1972, iv + 34 pp., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

378. Marine flora and fauna of the northeastern United States. Protozoa: Ciliophora. By Arthur C. Borror. September 1973, iii + 62 pp., 5 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

379. Fishery publications, calendar year 1969: Lists and indexes. By Lee C. Thorson and Mary Ellen Engett. April 1973, iv + 31 pp., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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